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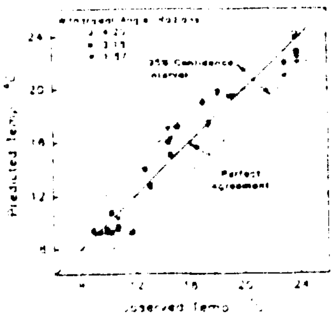

TECHNICAL REPORT HL-92-12

PROTOTYPE EVALUATION OF SELECTIVE WITHDRAWAL SYSTEM, TAYLORSVILLE DAM, SALT RIVER, KENTUCKY

by

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Prototype tests were conducted during 11-14 August 1986 at Taylorsville Dam, Kentucky, to evaluate the performance of the project's selective withdrawal system. Taylorsville Dam is located on the Salt River in north-central Kentucky 50 miles above the confluence with the Ohio River. The existing project consists of a rock-filled dam, uncontrolled spillway, and controlled outlet works. Reservoir releases are regulated by a gated intake tower consisting of two flood-control intakes at the base of the structure and two wet wells with five 6- by 6-ft water-quality intakes in each wet well. All flows pass through two separate 5.5- by 14.75-ft rectangular passages transitioning into a single 11.5- by 14.75-ft oblong conduit.

The primary purpose of the prototype measurement program was to obtain prototype information on the performance of the selective withdrawal system. The data are used to determine the reservoir withdrawal zone characteristics, intake tower blending characteristics, the occurrence of density blockage, the

(Continued)

14. SUBJECT TERMS
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Dissolved oxygen
Model-prototype correlation
Multilevel intake
Prototype tests
Reaeration
(Continued)

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degree of mixing of different water qualities, and the amount of dissolved oxygen uptake. Results were also used to compare prototype performance with both physical and numerical model predictions.

The basic measurements included dissolved oxygen and temperature profiles in the reservoir, at locations within the outlet works, and at one station in the downstream channel. Two-directional intake velocity profiles were measured for each port and total discharge was measured in the downstream channel.

The water-quality data show that the Taylorsville water-quality intake structure can function effectively for release temperature control by selective withdrawal and that the system effectively reaerates flow through the structure. The results also show that the one-dimensional numerical model SELECT can predict release dissolved oxygen concentration and temperature for Taylorsville. Density blockage of the upper ports due to reservoir density stratification occurs during the multilevel tests at flows less than 100 cfs.

The hydraulic measurements revealed basically uniform flow distributions within each intake. The prototype data for submerged orifice flow fall slightly below the physical model data. Discharge coefficients for the total water-quality system were computed to be less than those determined in the model.

14. SUBJECT TERMS (Continued).

Selective withdrawal
Velocity profiles
Water quality

PREFACE

The prototype tests described herein were conducted during August 1986 by the US Army Engineer Waterways Experiment Station (WES) under the sponsorship of the US Army Engineer District, Louisville.

The overall test program was conducted under the general supervision of Messrs. F. A. Herrmann, Jr., Director of the WES Hydraulics Laboratory, M. B. Boyd, former Chief of the Hydraulic Analysis Division, and G. A. Pickering, Chief of the Hydraulic Structures Division. Mr. R. G. McGee, Hydraulic Analysis Branch, was the test coordinator. This report was prepared by Mr. McGee under the supervision of Messrs. E. D. Hart, former Chief of the Prototype Evaluation Branch, and Dr. B. J. Brown, Chief of the Hydraulic Analysis Branch; and by Mr. S. E. Howington under the supervision of Dr. J. Holland, Chief of the Water Quality Branch. Instrumentation support was provided by Mr. S. W. Guy under the supervision of Mr. L. M. Duke, Chief of the Operations Branch, Instrumentation Services Division, WES. Additional assistance in the investigation was provided by Mr. T. L. Fagerburg, formerly of the Hydraulic Structures Division and presently employed in the Estuaries Division. Plates were prepared by Mr. Mike Chu, Hydraulic Analysis Branch.

Acknowledgement is made to the personnel of the Louisville District for their assistance in the investigation.

At the time of publication of this report, Director of WES was Dr. Robert W. Whalin. Commander and Deputy Director was COL Leonard G. Hassell, EN.

CONTENTS

CONVERSION FACTORS, NON-SI TO SI (METRIC)
UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

Multiply	By	To Obtain
degrees (angle)	0.01745329	radians
cubic feet per second	0.02831685	cubic metres per second
feet	0.3048	metres
inches	2.54	centimetres
miles (US statute)	1.609344	kilometres
pounds (force) per square inch absolute	6.894757	kilopascals

PROTOTYPE EVALUATION OF SELECTIVE WITHDRAWAL SYSTEM

TAYLORSVILLE DAM, SALT RIVER, KENTUCKY

PART I: INTRODUCTION

Pertinent Features of the Project

1. Taylorsville Dam (Figure 1) is located on the Salt River in north central Kentucky 50 miles* above the confluence with the Ohio River and 4 miles upstream of Taylorsville, KY (Figure 2).

2. The existing project consists of a rock-filled dam, an uncontrolled spillway in the right abutment, and a controlled outlet works through the right abutment. The top of the dam is at el 622.0,** with the spillway crest at el 592.0.

Outlet Works

3. Reservoir releases are regulated by a gated intake tower, consisting of two flood-control intakes at the base of the structure (el 474.0) and two wet wells with five 6- by 6-ft water-quality intakes in each wet well at elevations ranging from 503.0 to 534.0. Both flood-control and water-quality flows pass through two separate 5.5- by 14.75-ft rectangular gate passages. The two gate passages transition into a single 11.5- by 14.75-ft oblong conduit. The last 20 ft of the oblong conduit contains a transition to a flat-bottom conduit before discharging into an outlet transition and stilling basin. A general profile of the outlet works is given in Plate 1.

4. During selective withdrawal operations, the emergency gates are closed and flow is discharged through the multilevel intakes into the wet wells and through an opening in the roof of the gate passages between the emergency and service gates. The service gates are used to regulate the

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* A table of factors for converting non-SI units of measurement to SI (metric) units is presented on page 3.

** All elevations (el) and stages cited herein are in feet referred to the National Geodetic Vertical Datum.

Figure 1. Taylorsville Dam and Lake

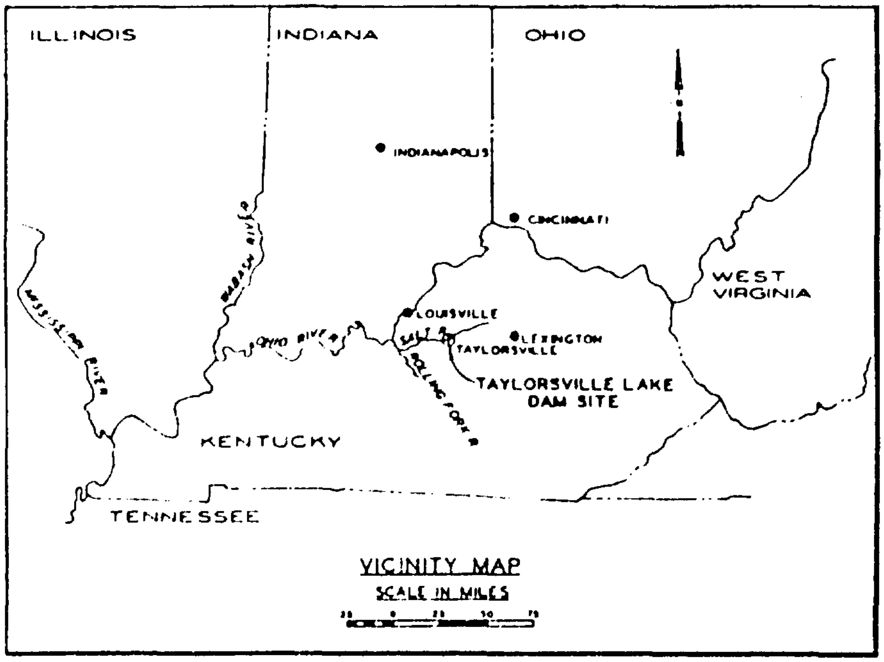

Figure 2. Vicinity map

selective withdrawal releases. The locations of the 10 multilevel intakes (5 intakes in each wet well) are shown in Plate 2. An 18-in.-diam pipe bypass around each service gate is provided (refer to Plate 2) to regulate the release of small flows with the service gates closed.

Purpose and Scope of Tests

Purpose

5. The primary purpose of these tests was to obtain prototype information on the performance of the selective withdrawal system. Prototype information is needed to confirm and/or improve techniques in designing systems to perform selective withdrawal operations. By knowing prototype temperature and dissolved oxygen (DO) profiles in the reservoir, and temperature and DO entering an intake, characteristics of the withdrawal zone can be determined. By knowing the distribution of flow among the open intakes, and temperature and DO of flow passing out of the wet well(s), blending characteristics of the system can be determined. Measurements of flow distribution among the intakes can also be used to determine if phenomena such as density blockage occur. Finally, measurements downstream of the outlet works stilling basin (similar to those in the reservoir) determine the degree of mixing of different qualities and the amount of dissolved oxygen uptake by reaeration through the outlet works. These results would be useful in guiding project operations.

6. A secondary purpose of these tests was to use prototype measurements of the reservoir temperature and DO profiles and the resulting outflow characteristics to evaluate the accuracy of the US Army Engineer Waterways Experiment Station (WES) selective withdrawal numerical model, SELECT.

7. Hydraulic measurements were made to determine prototype inlet two-dimensional velocity profiles. This information was used as confirmation of the discharge ratings indicated by the physical model (Dortch 1975). Water-surface elevation measurements of the reservoir and wet well(s) provided information regarding intake losses.

Scope

8. The subject tests were conducted at Taylorsville Dam during the period 11-14 August 1986. Dissolved oxygen and temperature profiles were measured in the reservoir, at one location within the outlet works, and at one station in the downstream channel for varying test conditions. The

measurement stations are listed below (see also Plates 1 and 2).

Measurement Station	Location and Description
1	Reservoir: Every 5 ft (every foot through the metalimnion) from the surface to the bottom
2	Flood control conduit: Below the wet well; sample taken from 18-in. bypass around service gate (both gates)
3	Channel: About 600 ft downstream of the stilling basin

9. Intake velocity profiles were measured for each operating port just upstream of the intakes in the trashrack guide slots. Total discharge was measured in the downstream channel about 600 ft downstream of the stilling basin.

PART II: TEST FACILITIES AND EQUIPMENT

Water-Quality Measurements

10. Dissolved oxygen content and temperature were the primary water-quality parameters measured. HYDROLAB Water Quality Monitoring Systems were utilized to measure temperature, DO, and depth in the reservoir, in the right and left wet-well structures, and at the tailwater monitoring stations. The US Army Engineer District, Louisville, provided both the equipment and the personnel to acquire these data.

11. Water-quality samples for each of the wet wells were drawn from the 18-in. low-flow bypass conduits located at el 476 just downstream of the wet-well entrances into the flood control conduit (refer to Plate 2). The samples were collected through piezometer lines from the bypass elbow that terminated in the service gate chamber. The HYDROLAB was connected directly to the piezometer line as shown in Figure 3.

Intake Velocity Measurements

12. Marsh-McBirney Model 511 electromagnetic current meters were used to make the intake velocity measurements. These instruments collect two-directional velocity data in the horizontal plane from which both the magnitude and direction components of the velocity vector are obtained. A specially designed meter carriage was fabricated for the Taylorsville structure to rigidly mount the meters and to provide accurate positioning of the meters. Figure 4 shows the mounting frame with meters attached and Figure 5 shows the meter assembly as deployed at Taylorsville. The data for each inlet were collected in a 3- by 3-ft grid configuration at 2-ft vertical and horizontal intervals. Figure 6 shows typical velocity meter cross-section locations.

Other Measurements

13. Total discharge through the structure was measured at a discharge range approximately 600 ft downstream of the stilling basin. This was the same station used for the tailwater water-quality measurements. Stream

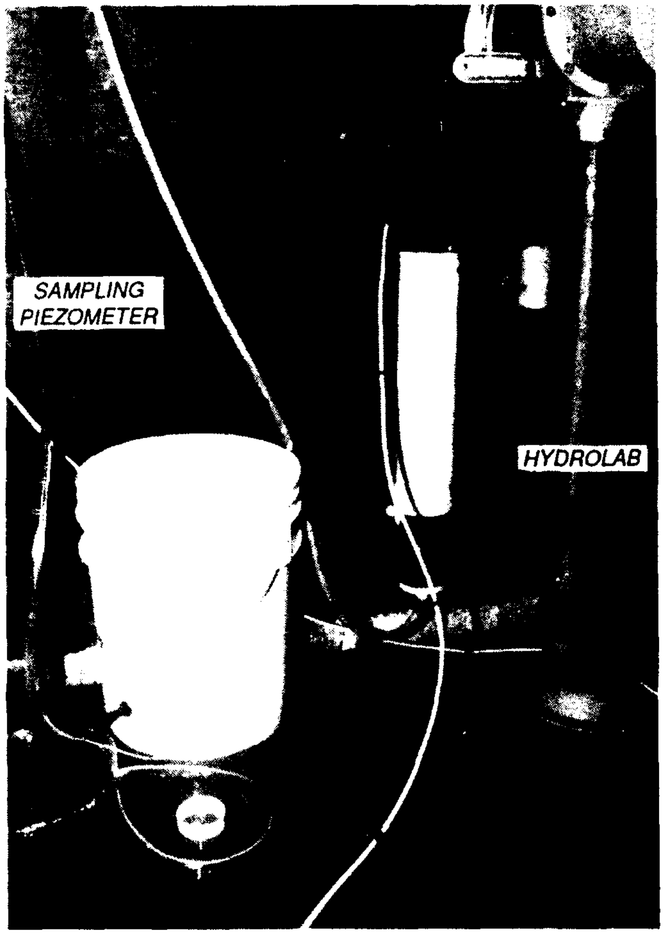

Figure 3. Wet well water-quality measurement

velocity profiles were run for each test at this station by personnel of the Louisville District, as seen in action in Figure 7.

14. To verify the water-quality intake rating curves, it was necessary to determine the differential head between the reservoir and the wet well. Three 15-psia pressure transducers (RPR, RPC, RPL) were placed just below the water surface along the face of the intake structure to continuously monitor the reservoir elevation during testing. Water-surface elevations in the wet wells were continuously measured with 50-psia pressure transducers (WWR, WWL) attached to ladders in each wet well. The reader is referred to Table 1 and Plates 1 and 2 for each transducer's description and location. These concurrent measurements provided continuous measurements of the differential head for the entire test program.

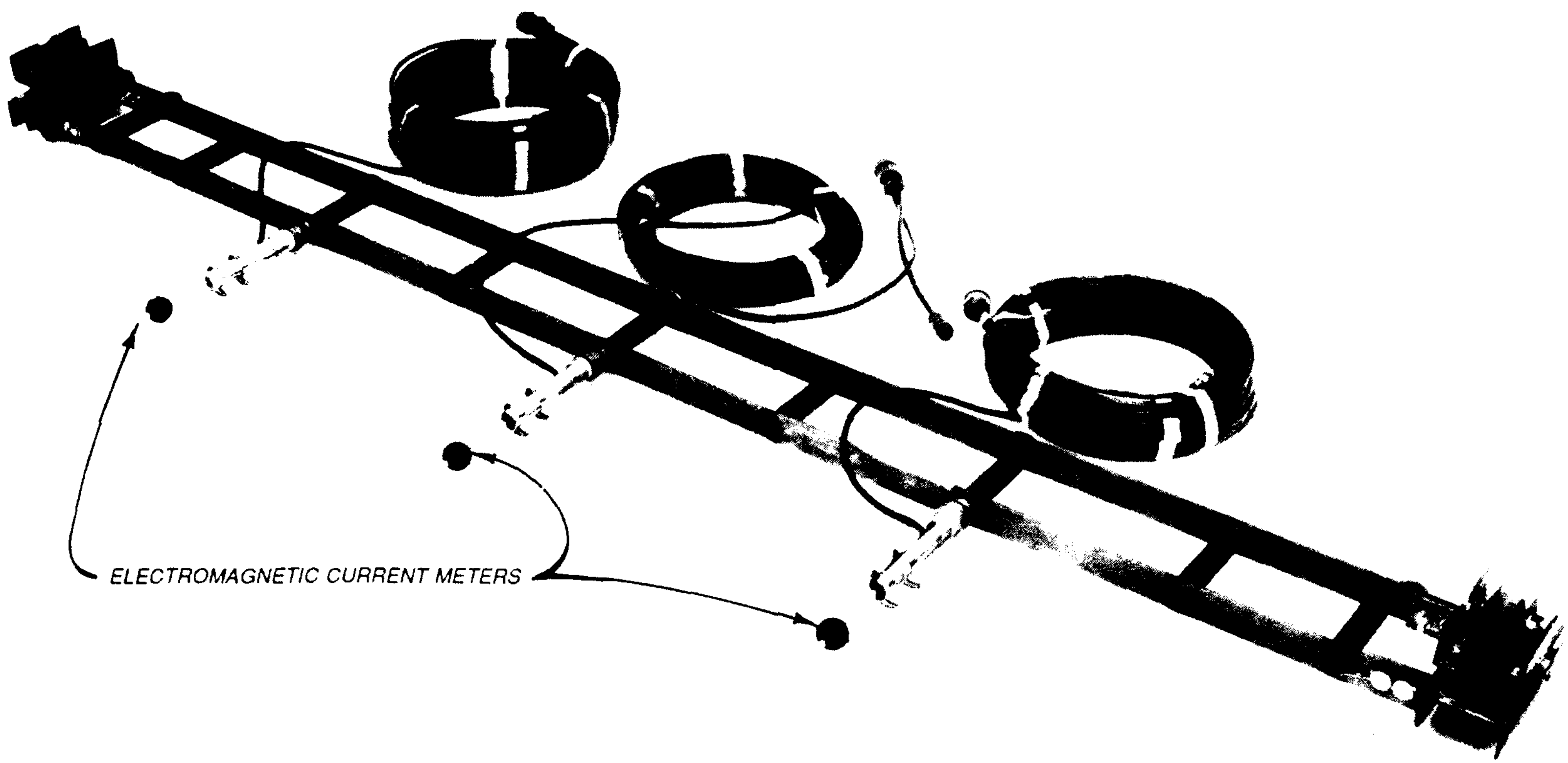

Figure 4. Velocity meter carriage assembly

Figure 5. Velocity meter carriage assembly as deployed at Taylorsville

Data Acquisition

15. Data from the water-quality and stream-discharge measurements were collected and recorded by personnel of the Louisville District. The intake velocity and reservoir and wet-well water-surface elevation data were all collected simultaneously using digital data acquisition equipment operated by WES personnel.

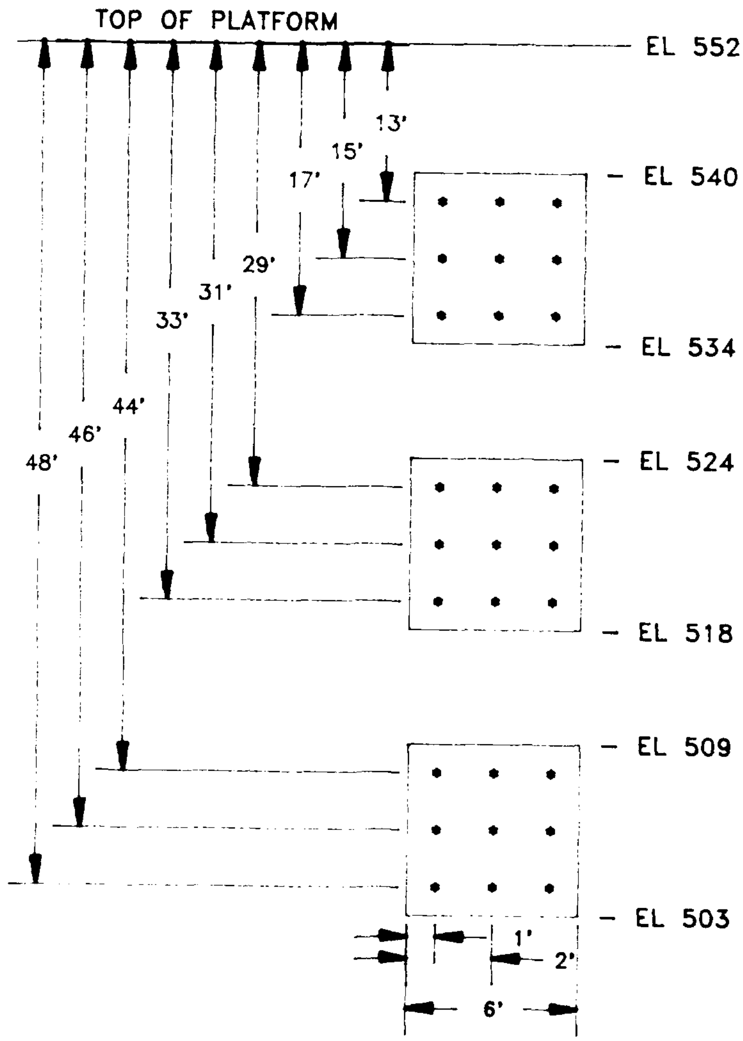

Figure 6. Typical velocity meter cross-section locations

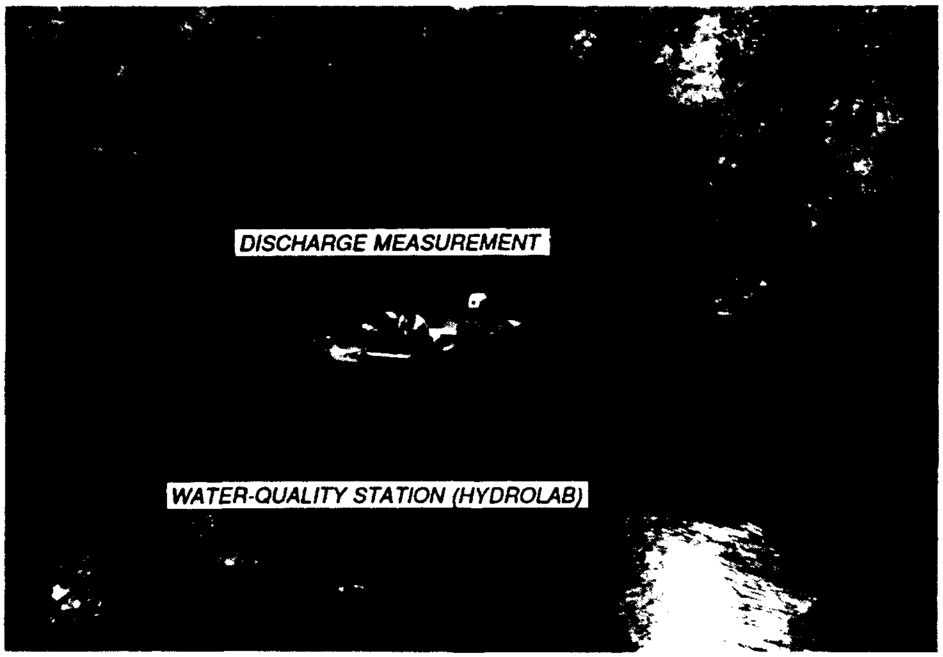

Figure 7. Tailwater discharge range

PART III: TEST CONDITIONS AND PROCEDURES

Operating Conditions

16. Seventeen tests were conducted at Taylorsville Dam. The conditions for each test are listed in Table 2. All tests were performed while passing flow through the water-quality system. Two tests were conducted during low flows using the service gate bypass conduits (refer to Plate 2) for flow control. The reservoir pool elevation remained practically constant at about el 546.5 throughout the testing program. Variables in the testing program were number and location of intakes open and the total discharge through the structure.

Test Procedures

17. Reservoir DO and temperature profiles were measured three times per day: (1) prior to testing, usually in the early morning, (2) during testing, around midday, and (3) after testing, usually in the late afternoon. Profiles were considered representative for the tests conducted following each profile. The intake water quality and velocity test procedures were as follows:

- a. Calibrate all instruments at baseline condition (no flow).
- b. Make intake and control gate settings. Allow flow to stabilize at steady-state condition (3-5 min).
- c. Collect all pertinent data in intake structure.
- d. Measure downstream discharge, DO, and temperature.
- e. Adjust intake and gates for the next test.

18. As described in Part II, the wet-well water-quality measurements were obtained from water drawn through piezometers connected to the low flow bypass conduit. In order to get the most accurate measurements, samples were drawn after the bypass conduits were opened, allowed to flush, and then closed. Except for those tests specifically planned for bypass flows, the bypass conduits were not open while measuring intake velocity or downstream discharge.

19. The downstream discharge, DO, and temperature measurements were not accomplished until it was assured that the water withdrawn from the lake and measured in the wet wells was the same as that passing the measurement

station. This required waiting for up to 1 hr from the start of some tests before making the measurements.

PART IV: TEST RESULTS

Release Water Quality

20. The primary purpose of the testing program, as stated in paragraph 5, was to assess the performance of the Taylorsville Dam selective withdrawal system. The prototype data collected were analyzed to determine the effects of structure operation on the release water quality; i.e., temperature and DO. The water-quality analyses included selective withdrawal, in-structure reaeration, and simultaneous multiple-level withdrawal.

Selective withdrawal

21. Vertical movement in a thermally stratified and, therefore, density-stratified lake is limited by buoyancy forces. Selective withdrawal makes use of this effect to permit the release of water from a vertically confined region in the lake. Multiple port elevations, therefore, often translate into multiple choices for release temperature and other vertically stratified water quality components (e.g., DO). Table 3 demonstrates the variation in tailwater temperatures resulting from different selective withdrawal operations. The data are also presented in Plates 3-25 and show the reservoir profiles, test conditions, and wet-well and tailwater temperatures and DO concentrations. These data show that the Taylorsville water-quality intake structure provides effective selective withdrawal temperature operations.

22. The SELECT one-dimensional reservoir withdrawal model (Davis et al. 1987) is used to predict release water-quality characteristics from thermally stratified lakes. The in-lake temperature profiles and individual port flows measured for the testing program at Taylorsville provided inputs to SELECT. The SELECT predictions of release water temperature were then compared with the observations. Two tests, numbers 10 and 15, were excluded from these analyses of temperature and dissolved oxygen. In both of these tests, only one wet well was used. However, the release temperature was markedly different than the in-structure temperature measurement, indicating a problem with these two tests.

23. A site-specific parameter within the SELECT model, the withdrawal angle, accounts for the effects of the near-field topography on the in-lake withdrawal patterns. This parameter is often determined through scale model

testing of an intake structure. For this field study, several withdrawal angles were tested with the SELECT model to find the one that provided the best correlation between SELECT predictions and observed release temperatures. The model predictions for three withdrawal angles are compared to observations in Figure 8. The predictions appear insensitive to variations in withdrawal angle. The most appropriate withdrawal angle was chosen to be about 4.2 rad, or about 240 deg, since this angle appears to provide the best fit and be the most physically reasonable. One would expect a withdrawal angle between 180 and 360 deg from the plan-view geometry at this site. The 95-percent confidence interval for these predictions is ±2.25° C and the standard deviation is 1.15° C.

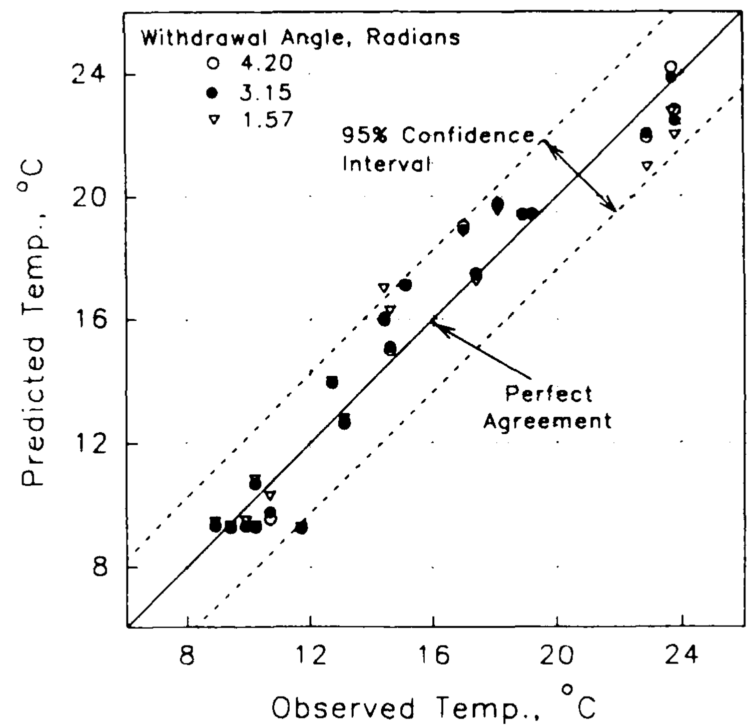

Figure 8. Selective withdrawal evaluation; temperature

<u>In-structure reaeration</u>

24. By comparing the in-wet-well DO measurements and the release DO measurements, it was obvious that a significant amount of reaeration occurred between the service gates and the downstream data-collection station. These data can be compared in Table 3 and Plates 3-25. Other prototype evaluations (Hart and Wilhelms 1977, Wilhelms and Smith 1981) have shown that a major portion of the reaeration occurs downstream of the service gates where high air

entrainment exists, induced by relatively shallow, turbulent, super-critical flow.

25. For the Taylorsville testing program the minimum observed downstream DO concentration (excluding tests 10 and 15) was 7.6 ppm (test 1). All other readings were above 7.6 ppm, with some as high as 9.9 ppm, even though the in-wet-well DO concentration was often small. This indicates that the Taylorsville outlet works effectively reaerates flow through the structure regardless of the level of withdrawal.

26. SELECT contains a routine for predicting the amount of reaeration that will occur through a conventional gated conduit and stilling basin. This routine is based on the work by Wilhelms and Smith (1981) and used an empirically derived escape coefficient. To apply this feature of the code, it must be assumed that the in-wet-well DO concentrations are accurately approximated by SELECT. Since selective withdrawal had been confirmed through comparing release temperatures, this was a reasonable assumption. Figure 9 shows the predicted and observed release DO concentrations with the original ($0.045\ ft^{-1}$) escape coefficient and a revised ($0.032\ ft^{-1}$) coefficient that better represents the Taylorsville data. Although the original coefficient causes SELECT to consistently overpredict the release DO, the errors were

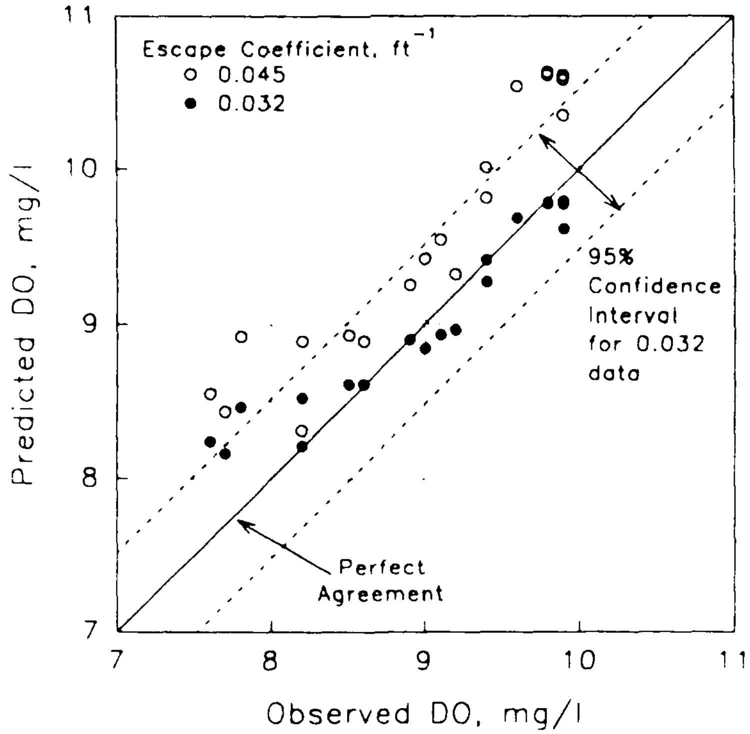

Figure 9. Selective withdrawal evaluation; dissolved oxygen

small relative to the amount of DO uptake. With the revised coefficient, the predictions are very good. The standard deviation is 0.26 mg/ℓ, and the 95-percent confidence interval is ±0.52 mg/ℓ.

Simultaneous multiple level withdrawal

27. When multiple ports are open in a density-stratified fluid and a single point of flow control is used for both ports, as is the case with a single wet well, the distribution of flow among the ports may be significantly different than would occur in a pool of uniform density. In an extreme case, the reservoir density stratification can cause density blockage, effectively preventing flow through some open ports during multiple port operations. A number of tests were performed to assess the effects of density stratification on multiple-level withdrawal operations at Taylorsville. Only those tests that employed more than one open port in a single wet well were applicable for this evaluation. Intake velocity profile data for all tests are presented in Plates 26-49. The intake velocity data from tests 8A, 8B, 14A, 14B, and 14C revealed density blockage of the upper ports during multi-level operations. These data are shown under 'Q per intake' in Table 3 and the individual point velocities are shown in Plates 32, 33, 42, 43, and 44. Test 15 revealed the absence of flow through the upper side port, but the presence of flow through the upper front port. This is inconsistent with the present theory, and not attributable to density effects.

28. The stratified-flow-distribution (SFD) algorithm developed by WES (Howington 1990) was applied in a predictive capacity for the Taylorsville tests with the results shown in Figure 10. Head loss testing (summarized in Plate 50) was used to compute the approximate Darcy-Weisbach loss coefficient needed by the algorithm. This coefficient was determined to be 1.6. The results indicate a good agreement between predictions and observations, with a standard deviation of 0.11 and a 95-percent confidence interval of ±0.22. When one considers that the uppermost open port flow for a particular density stratification (QU) divided by the flow expected without density stratification (QH) is always equal to 1.0 without density effects, it appears that the general trends are reproduced well for the Taylorsville data.

29. Figure 11 more clearly shows the trends with increasing discharge. This figure gives total discharge (QT) divided by critical discharge (QC) along the x axis. Critical discharge is the discharge at which, for the given stratification and gate openings, the buoyant forces offset the hydraulic

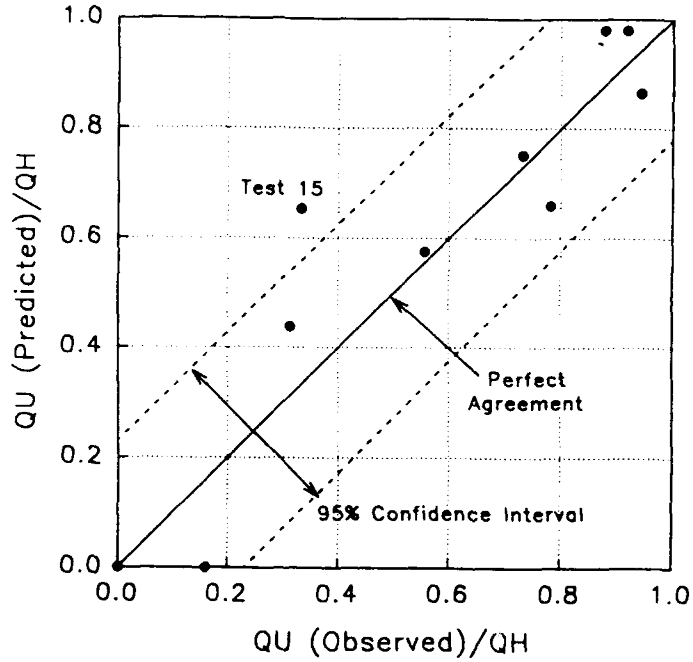

Figure 10. Comparison of predicted and observed density effects on flow distribution

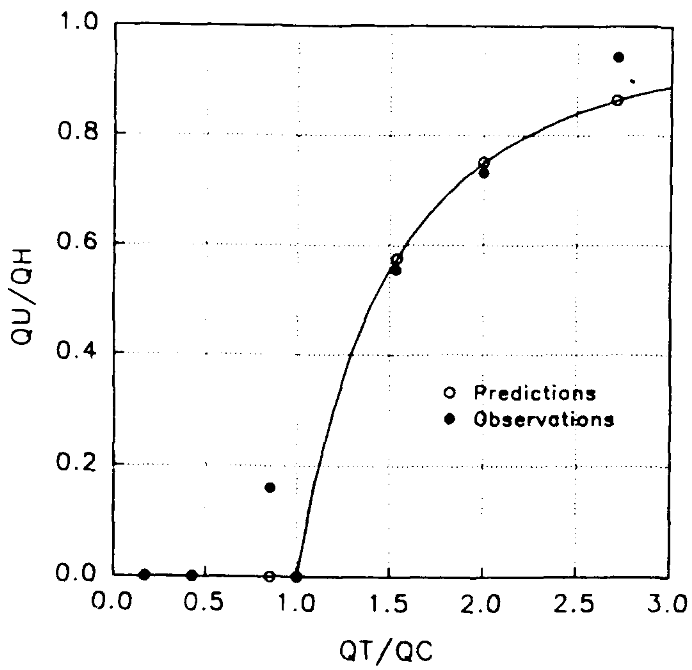

Figure 11. Trends with variation in discharge

losses, and flow through "blocked" ports is incipient. Therefore, along the x axis, the value of 1.0 is associated with critical discharge.

30. On the y axis of Figure 11, QU/QH is plotted. A y value of 0.0 corresponds to density blockage of the uppermost port. When the y value is 1.0, the effects of density on the flow are nonexistent. The effects of density on the flow distribution are more pronounced at the lower total discharges, and diminish as the total discharge increases.

31. Although few tests were available to compare against predictions, they compare favorably. With the exception of test 15, the most significant deviation between the predictions and observations occurred near critical discharge. This closely follows established trends (Howington 1990) and is in an area that is unlikely in normal reservoir operations. That is, operation very near critical discharge with multiple ports open would not be a practical operating scenario. As mentioned earlier, test 15 shows 22 cfs through the upper front port and no flow through the upper side port. This contradicts the logic of the SFD algorithm and common sense. Hopefully, this represents an error in the data and not a physical phenomenon.

Hydraulic Measurements

Intake velocity

32. Intake velocity profile data were collected for the open intakes on all tests. These data provided the assessment of density blockage discussed in the previous section and the distribution of flow among the ports during multiple inlet operations. In addition, velocity vectors describing the magnitude and flow direction were generated at each measurement location. Plates 26-49 present these data. For single intake operations in each wet well, a basically uniform flow distribution existed. For multi-level operations in the wet wells, the flow distribution varied from intake to intake, as in the density blockage case (see paragraph 27). For some tests, the percentage of flow through lower gates in multi-level operations was slightly higher than that of the higher inlets due to pressure and density effects (see Plates 30 and 38).

Model-prototype comparison

33. A hydraulic model investigation of the outlet works was conducted at WES (Dortch 1975). Plate 50 provides a comparison of the hydraulic model

and the prototype submerged orifice discharge rating characteristics for flow through a single 6- by 6-ft inlet. The prototype compared favorably with model predictions, with the prototype measurements falling just slightly below the model. Empirical equations developed by least squares regression describing the rating curves are given in the plate for both the model and the prototype. The prototype intake discharge coefficient C_I was computed by the equation

$$C_I = \frac{Q_I}{A_I\sqrt{2g\Delta H_I}} \tag{1}$$

where

Q_I = measured intake discharge, cfs

A_I = area of intake, ft^2

ΔH_I = measured head loss through the intake, ft

A C_I of 0.76 was computed as the average of all tests with single inlet flow.

34. The discharge characteristics of the water-quality system were described as the discharge coefficient C from the equation

$$C = \frac{Q_W}{A_G\sqrt{2gH}} \tag{2}$$

where

Q_W = measured wet-well discharge, cfs

A_G = area of service gate opening, ft^2

H = measured head from pool to center of gate opening, ft

The computed C values are shown in Plate 50 plotted against percent gate opening. Since data were available for only three gate settings, all below 12.5 percent, no trend was established for the entire range of possible gate openings. Also, small errors in measurement are of much more significance at these lower gate settings, as indicated by the relative scatter in the data. The model values for C are also shown in Plate 50 and are somewhat higher than those measured. In addition, at this low end-of-gate setting, the C values for the right wet well fall slightly higher than the left wet-well values. A broader range of gate settings and flow is needed to better define the discharge characteristics of the water-quality system.

PART V: CONCLUSIONS

Water Quality

35. The data show that the Taylorsville water-quality intake structure can function effectively for release temperature control by selective withdrawal.

36. For all tests, the DO content of the release flows was above 7.0 ppm. The intake DO was very low, indicating that the Taylorsville water-quality system effectively reaerates flow through the structure.

37. The results show that SELECT can predict, with minor deviations, the release DO concentration and temperature for the Taylorsville water-quality system. The site-specific SELECT input parameter of withdrawal angle was determined to be 4.2 rad, or about 240 deg.

38. Reservoir density stratification caused density blockage of the upper ports during some of the multi-level tests. This was only observed for flows less than 100 cfs. However, the effect of density on flow distribution among the open ports was seen for most tests.

39. The SFD predictions compared well with the measured data. With one exception, the most significant deviation between the predictions and observations occurred near critical discharge, an insignificant discrepancy for real operations.

Hydraulic Measurements

40. Basically, uniform flow distribution exists within each intake. The model and prototype data for submerged orifice flow compared favorably, with prototype measurements falling just slightly below the model. The empirically based prototype submerged discharge coefficient for a single intake, C_I, was 0.76.

41. Based on total head at the service gates and gate position, discharge coefficients for the water-quality system C were computed to be less than those determined in the model.

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Table 1

Hydraulic Measurement Equipment

Transducer Designation	Transducer Description: Type	Transducer Description: Range	Prototype Feature	Measurement	Computed Quantity
RPL	Pressure (absolute)	±15 psia	Intake tower, left side	Pressure, static	Reservoir Pool Elevation
RPC	Pressure (absolute)	±15 psia	Intake tower, center	Pressure, static	
RPR	Pressure (absolute)	±15 psia	Intake tower, right side	Pressure, static	
WWL	Pressure (absolute)	50 psia	Left wet well	Pressure, static	Head Loss In-wet-well
WWR	Pressure (absolute)	50 psia	Right wet well	Pressure, static	
VA1X	Marsh-McBirney	±20 FPS	6′ × 6′ Inlet Portal	Velocity (x)	Velocity magnitude & direction
VA1Y	Electromagnetic			Velocity (y)	
VA2X	2-D Current				
VA2Y	Velocity Meters				
VA3X					
VA3Y					
VB1X					
VB1Y					
VB2X					
VB2Y					
VB3X					
VB3Y					

Table 2

Test Conditions

Test No.	Intakes Open*	Total Discharge cfs	Pool el	Aug 1986 Date	Time HHMM
1	LF-T, RF-T	488	546.59	11	1128
2	RF-T	252		11	1417
3	LF-T, RF-M	340		11	1522
5	LF-B, RF-B	360		11	1630
6	LF-T, RF-T LF-M, RF-M	992		11	1732
7	LF-M, RF-M	617	546.51	12	1634
8A	LF-T, LF-B	10		12	1149
8B		25		12	1336
8C		50		12	1409
8D		91		12	1445
8E		159		12	1530
9	LF-T, RF-M	147	546.59	11	1826
10	RF-T, RF-M	71	546.51	12	1030
11	LF-T, RS-M	366	546.51	12	1743
12	LS-M, RS-M	1024	546.51	12	NR**
13	LS-T, RS-T	679	546.46	13	1416
14A		10	546.39	14	0944
14B		25		14	1019
14C		50		14	1054
14D		91		14	1257
14E		169		14	1341
15	RS-T, RF-T RF-M	99	546.46	13	1511
16	LS-T, LF-T RF-M	364	546.46	13	1630
17	LF-T	10	546.39	14	1445

* Note:
- M = Middle
- F = Front
- S = Side
- L = Left
- R = Right
- T = Top
- B = Bottom

** NR = not recorded.

Table 3

Structure and Tailwater Water-Quality Measurements,

Taylorsville Dam, August 1986

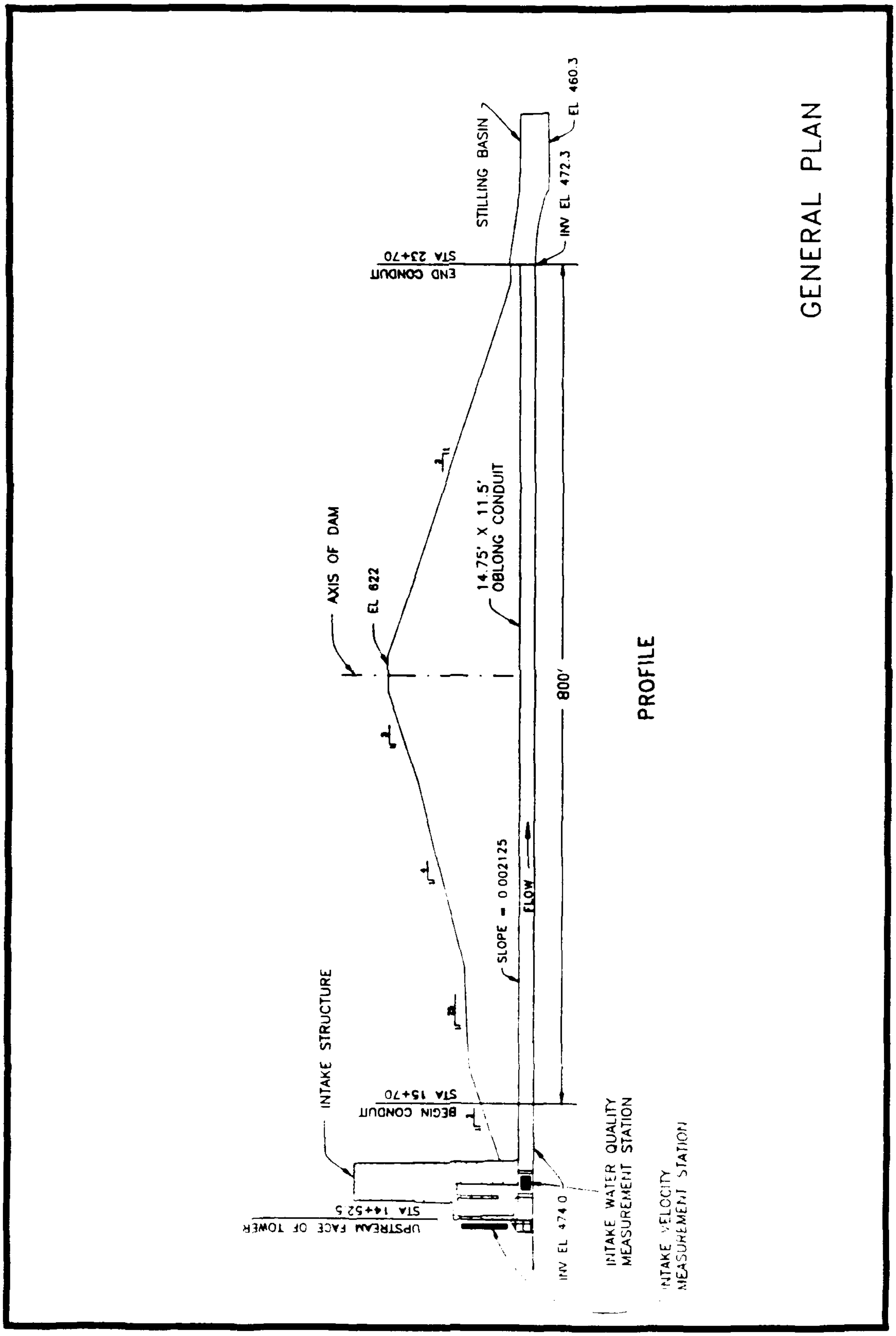
		Q	Intake Tower*								
			Left Wet Well		Right Wet Well		Tailwater			Test Begin	
Test No.	Intakes Open	Per Intake cfs	Temp, °C	DO, PPM	Temp, °C	DO, PPM	Temp, °C	DO, PPM	Q, CFS	Date	Time
1	LF-T	225	22.7	3.9	22.7	4.1	22.9	7.6	488	8/11/86	1128
	RF-T	264									
2	RF-T	252	-	-	23.7	4.8	23.8	7.7	252	8/11/86	1417
3	LF-T	167	24.4	5.2	13.8	0.3	18.9	8.2	340	8/11/86	1522
	RF-M	173									
5	LF-B	176	10.7	0.2	10.5	0.1	10.7	9.6	360	8/11/86	1630
	RF-B	183									
6	LF-T	228	16.9	2.2	17.1	2.2	17.0	7.8	992	8/11/86	1732
	RF-T	218									
	LF-M	268									
	RF-M	278									
7	LF-M	309	15.0	2.1	15.7	2.5	14.6	9.1	617	8/12/86	1634
	RF-M	308									
8A	LF-T	0	9.3	0.1	-	-	10.2	9.8	10	8/12/86	1149
	LF-B	10									
8B	LF-T	0	9.8	0.1	-	-	8.9	9.8	25	8/12/86	1336
	LF-B	25									
8C	LF-T	4	11.1	0.9	-	-	10.2	9.9	50	8/12/86	1409
	LF-B	46									
8D	LF-T	25	13.4	2.1	-	-	12.7	9.4	91	8/12/86	1445
	LF-B	66									
8E	LF-T	75	14.6	2.6	-	-	15.1	9.2	159	8/12/86	1530
	LF-B	84									
9	LF-T	(53%)	No Data		No Data		17.5	7.8		8/11/86	1826
	RF-M	(47%)									
10	RF-T	26	-	-	17.9	3.0	23.0	7.0	71	8/12/86	1030
	RF-M	45									

(Continued)

* Data taken from 18-in. bypass in each side.

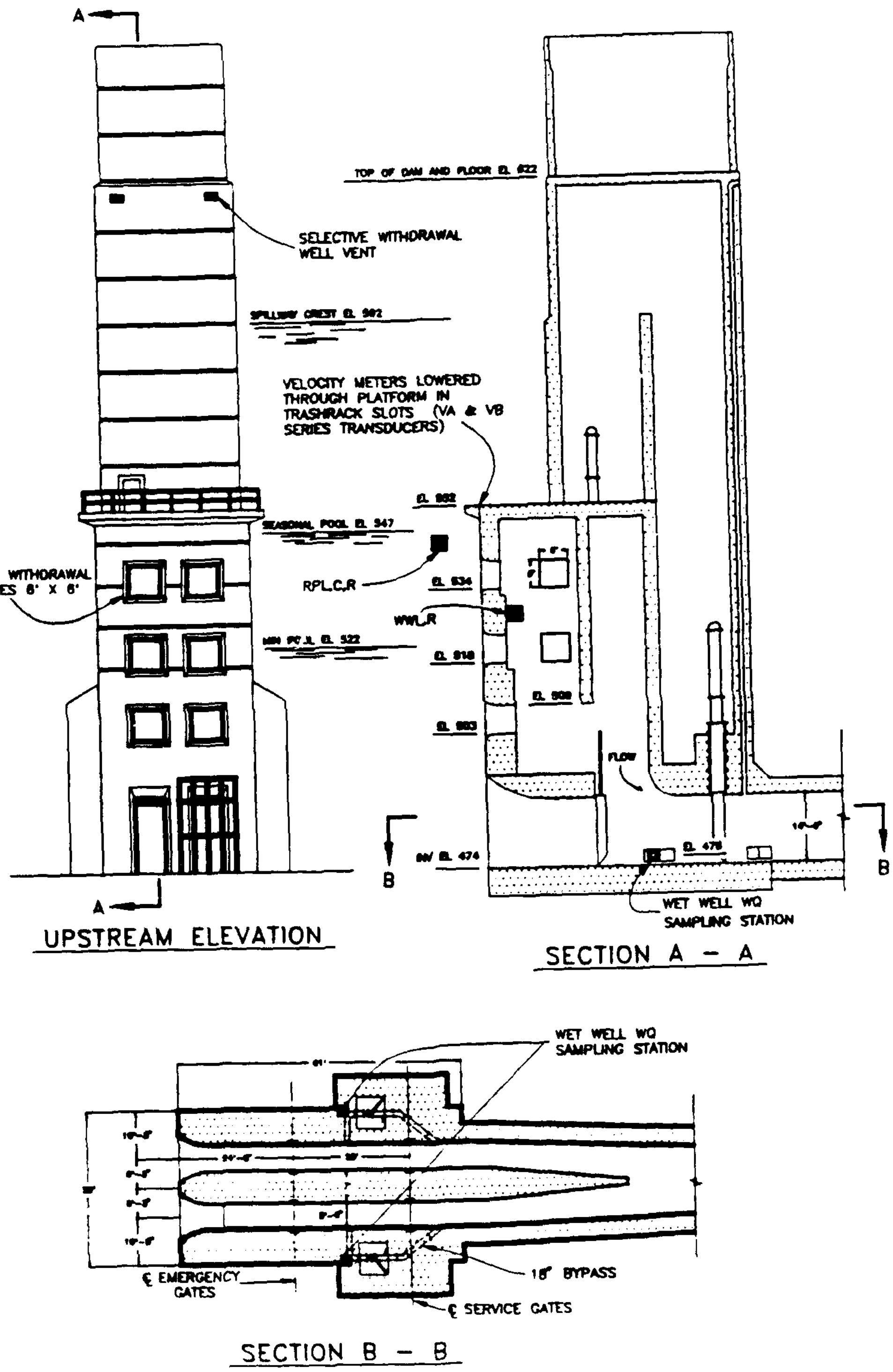
Table 3 (Concluded)

Test No.	Intakes Open	Q Per Intake cfs	Intake Tower: Left Wet Well Temp, °C	Left Wet Well DO, PPM	Right Wet Well Temp, °C	Right Wet Well DO, PPM	Tailwater Temp, °C	Tailwater DO, PPM	Tailwater Q, CFS	Test Begin Date	Test Begin Time
11	LF-T	176	21.9	6.1	14.0	1.3	18.1	8.6	366	8/12/86	1743
	RS-M	190									
12	LS-M	492	13.8	1.4	14.8	1.9	14.4	9.0	1024		
	RS-M	532									
13	LS-T	326	21.2	5.4	23.7	6.6	23.7	8.2	679	8/13/86	1416
	RS-T	353									
14A	LS-T	0	9.3	0.1	-	-	11.7	9.9	10	8/14/86	0944
	LF-T	0									
	LF-B	10									
14B	LS-T	0	9.3	0.1	-	-	9.4	9.9	25	8/14/86	1019
	LF-T	0									
	LF-B	25									
14C	LS-T	0	9.8	0.3	-	-	9.9	9.9	50	8/14/86	1054
	LF-T	0									
	LF-B	50									
14D	LS-T	5	12.9	1.8	-	-	13.1	9.4	91	8/14/86	1257
	LF-T	14									
	LF-B	72									
14E	LS-T	44	13.5	2.0	-	-	17.4	8.9	169	8/14/86	1341
	LF-T	44									
	LF-B	81									
15	RS-T	0	-	-	15.6	1.5	24.0	8.1	99	8/13/86	1511
	RF-T	22									
	RF-M	77									
16	LS-T	69	23.2	7.0	14.4	1.0	19.2	8.5	364	8/13/86	1630
	LF-T	102									
	RF-M	193									
17	LF-T	0	9.8	4.6	-	-	-	-	-	Wet Well With	
17	LF-T	10 (Qmin)	17.4	6.8	-	-	17.8	8.3	10(Qmin)	8/14/86	1445



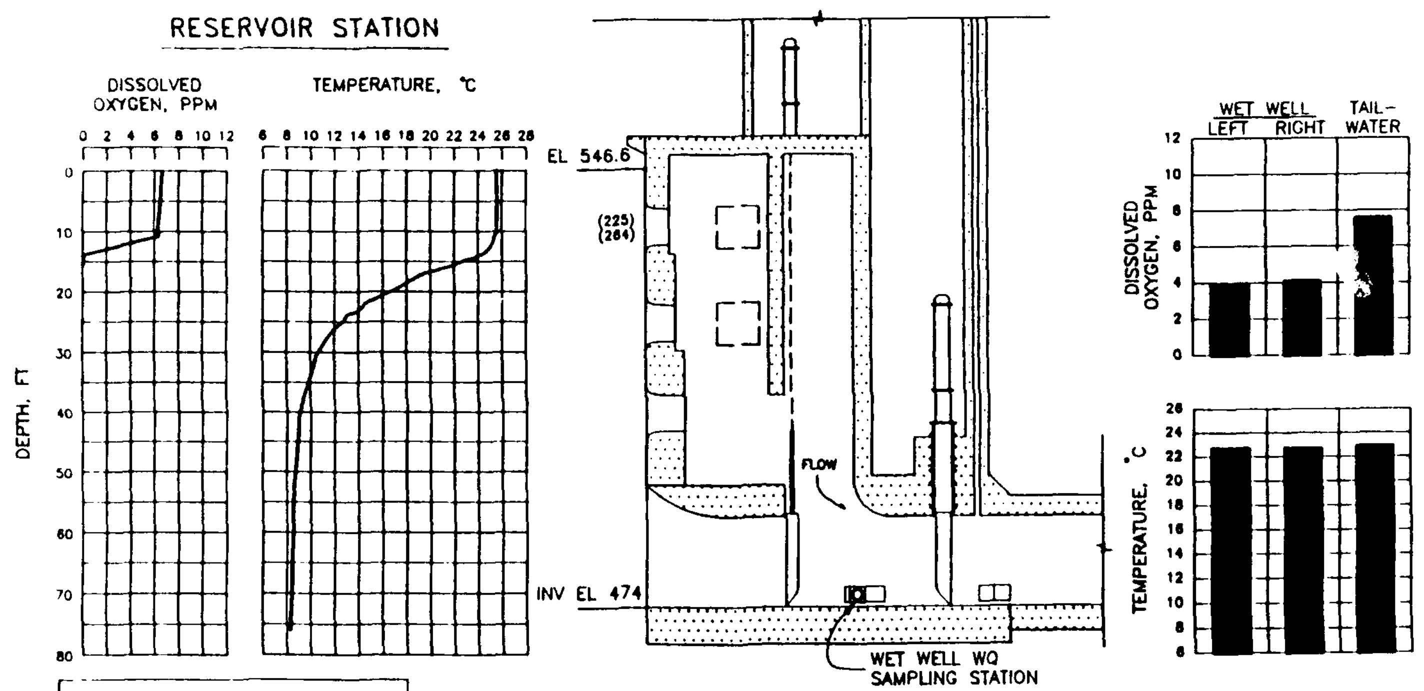
GENERAL PLAN
PROFILE
UPSTREAM FACE OF TOWER
STA 14+52.5
INTAKE STRUCTURE
BEGIN CONDUIT
STA 15+70
SLOPE = 0.002125
FLOW
AXIS OF DAM
EL 622
14.75' X 11.5' OBLONG CONDUIT
800'
END CONDUIT
STA 23+70
STILLING BASIN
INV EL 472.3
EL 460.3
INV EL 474.0
INTAKE WATER QUALITY MEASUREMENT STATION
INTAKE VELOCITY MEASUREMENT STATION

PLATE 1



INTAKE STRUCTURE

PLATE 2



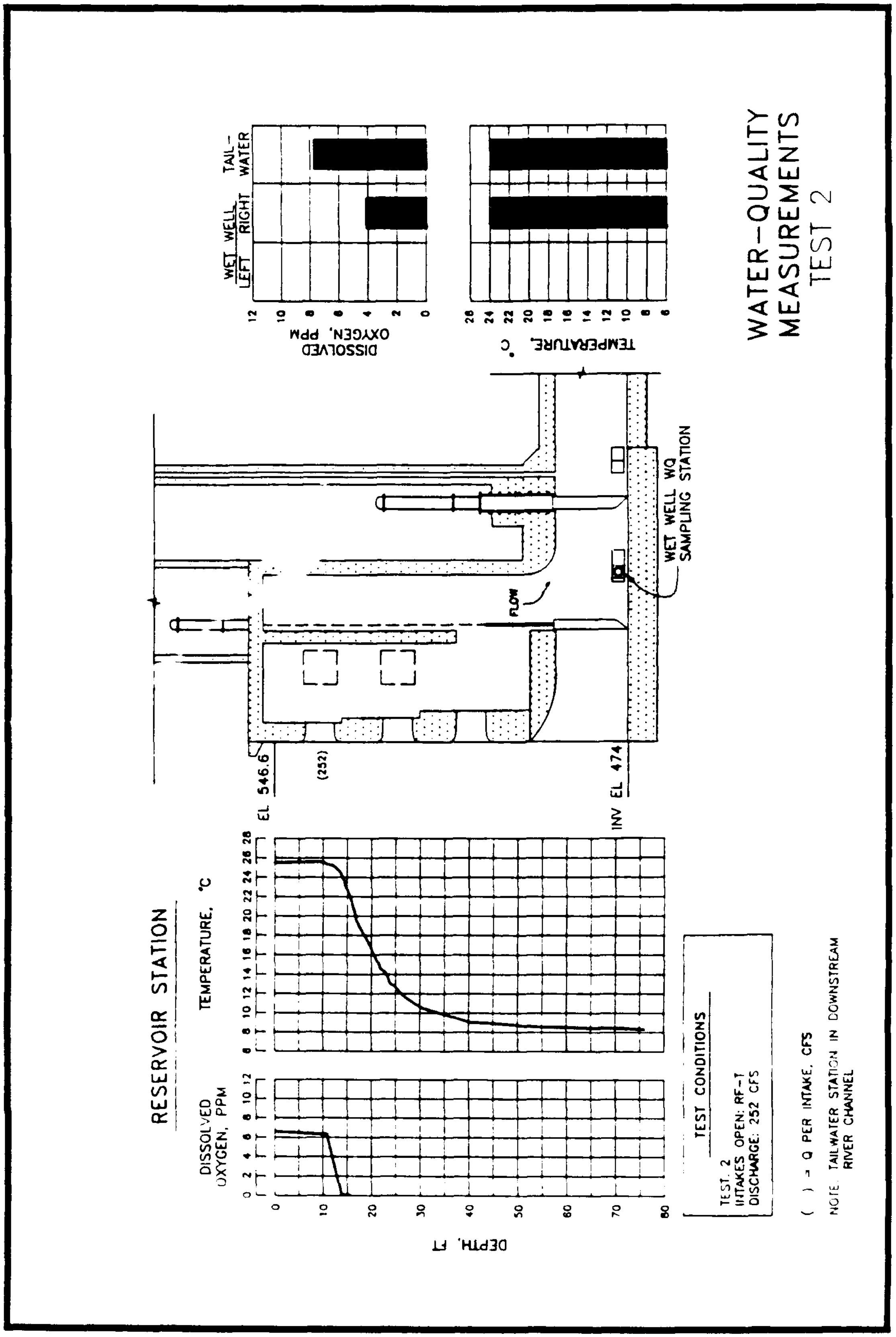
TEST CONDITIONS

TEST: 1
INTAKES OPEN: LF-T & RF-T
DISCHARGE: 488 CFS

( ) = Q PER INTAKE, CFS

NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

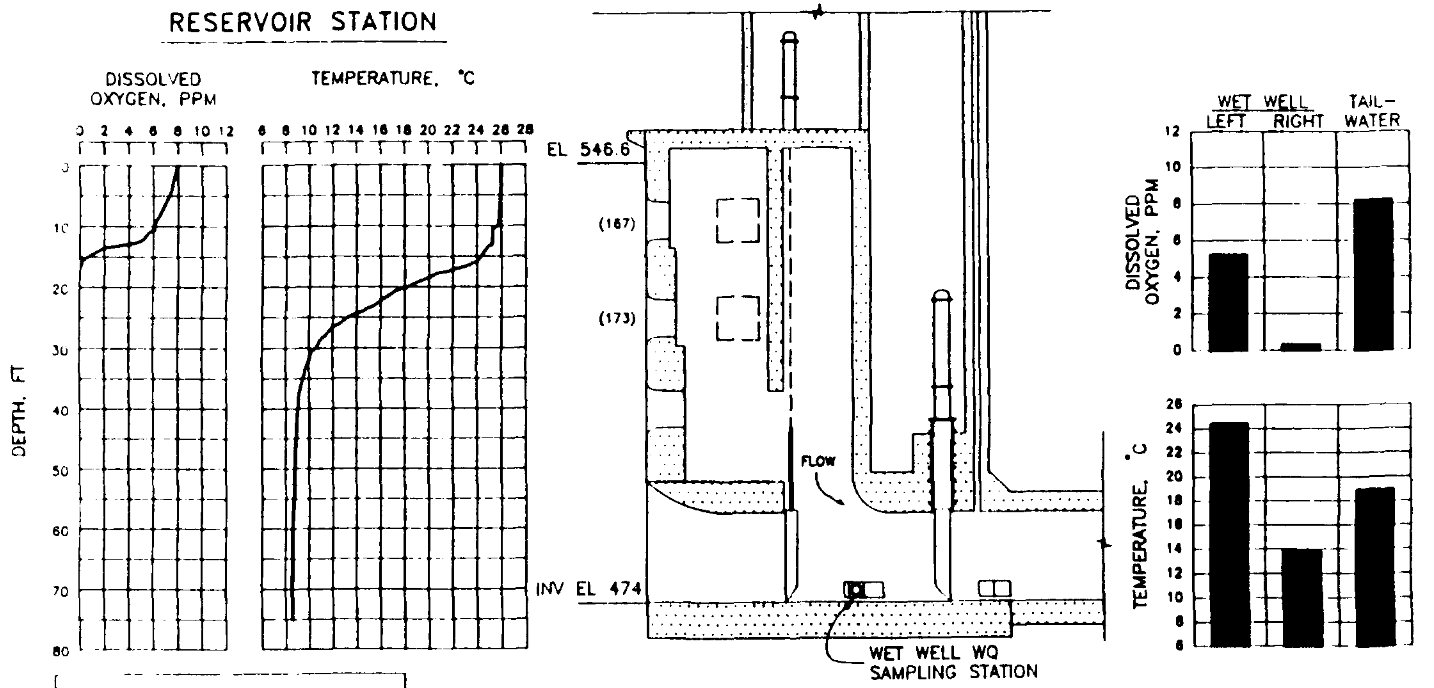
WATER-QUALITY MEASUREMENTS
TEST 1



RESERVOIR STATION
DISSOLVED OXYGEN, PPM
TEMPERATURE, °C
DEPTH, FT
EL 546.6
(252)
INV EL 474
FLOW
WET WELL WQ SAMPLING STATION
WET WELL
LEFT
RIGHT
TAIL-WATER
DISSOLVED OXYGEN, PPM
TEMPERATURE, °C
TEST CONDITIONS
TEST 2
INTAKES OPEN: RF-T
DISCHARGE: 252 CFS
( ) = Q PER INTAKE, CFS
NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL
WATER-QUALITY MEASUREMENTS
TEST 2

PLATE 4

RESERVOIR STATION



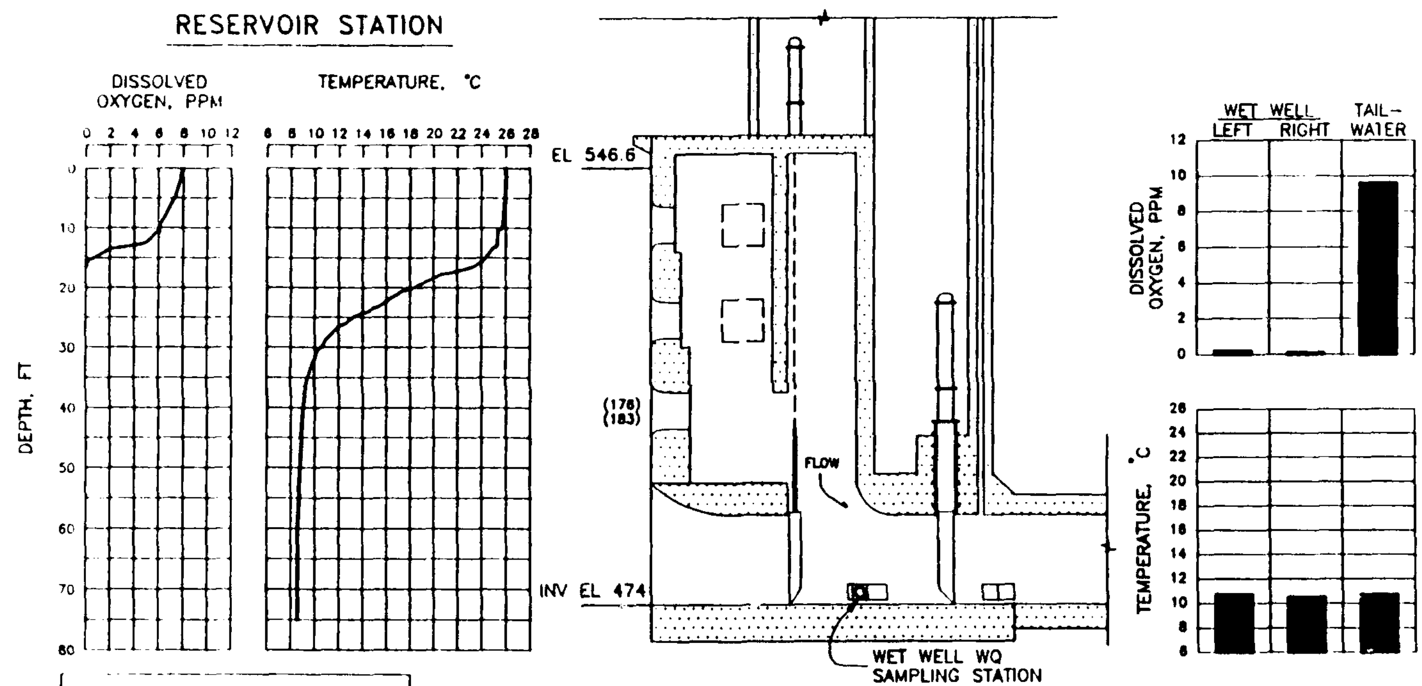
TEST CONDITIONS

TEST. 3
INTAKES OPEN: LF-T & RF-M
DISCHARGE. 340 CFS

( ) = Q PER INTAKE, CFS

NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

WATER-QUALITY MEASUREMENTS
TEST 3



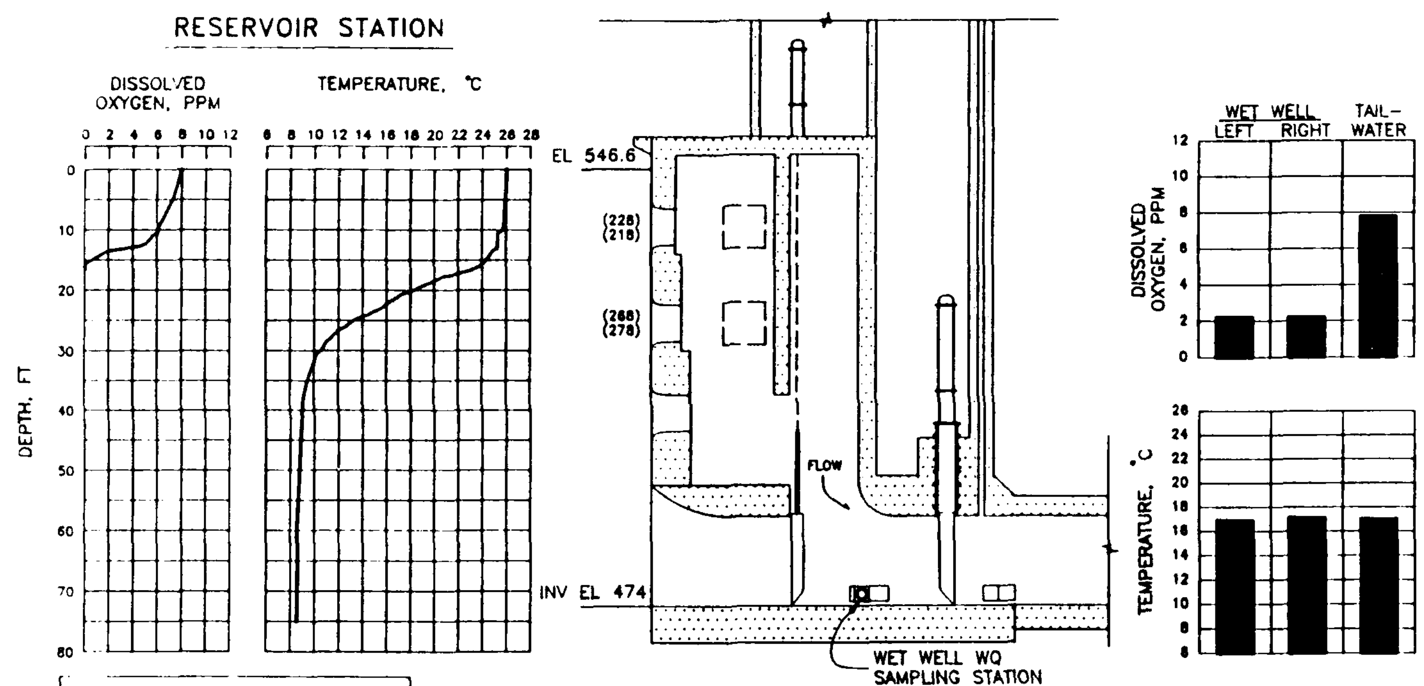
TEST CONDITIONS

TEST: 5
INTAKES OPEN: LF-B & RF-B
DISCHARGE: 360 CFS

( ) = Q PER INTAKE, CFS

NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

WATER-QUALITY MEASUREMENTS
TEST 5



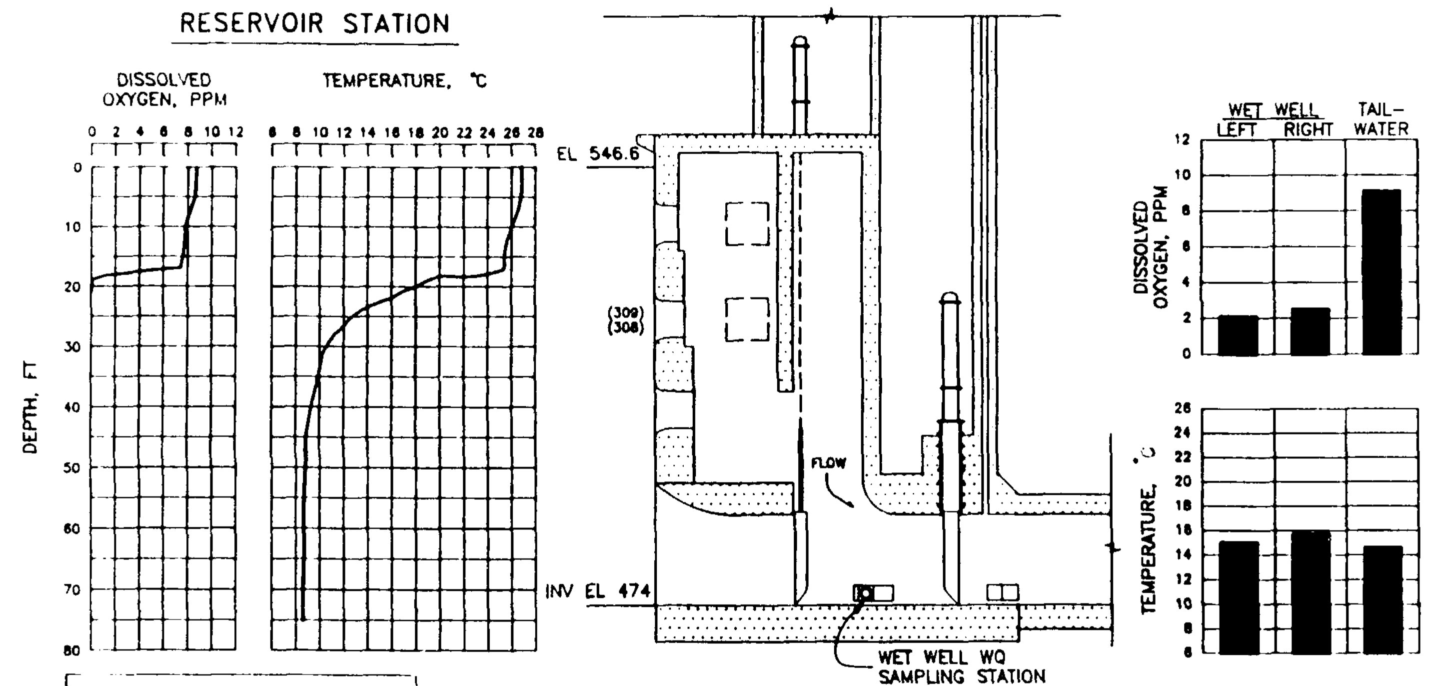
TEST CONDITIONS

TEST. 6
INTAKES OPEN: LF, RF-T & LF, RF-M
DISCHARGE: 992 CFS

( ) = Q PER INTAKE, CFS

NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

WATER-QUALITY MEASUREMENTS
TEST 6



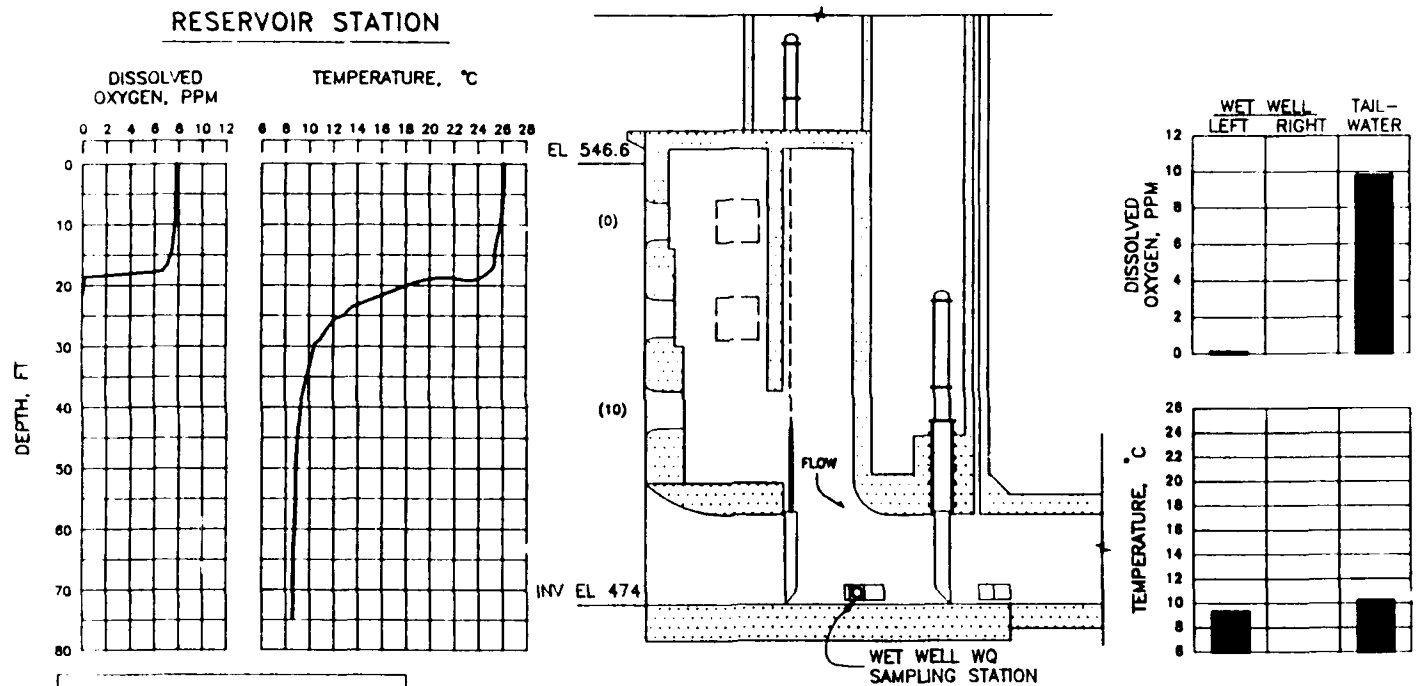
TEST CONDITIONS

TEST: 7
INTAKES OPEN: LF–M & RF–M
DISCHARGE: 617 CFS

( ) = Q PER INTAKE, CFS

NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

WATER–QUALITY MEASUREMENTS
TEST 7



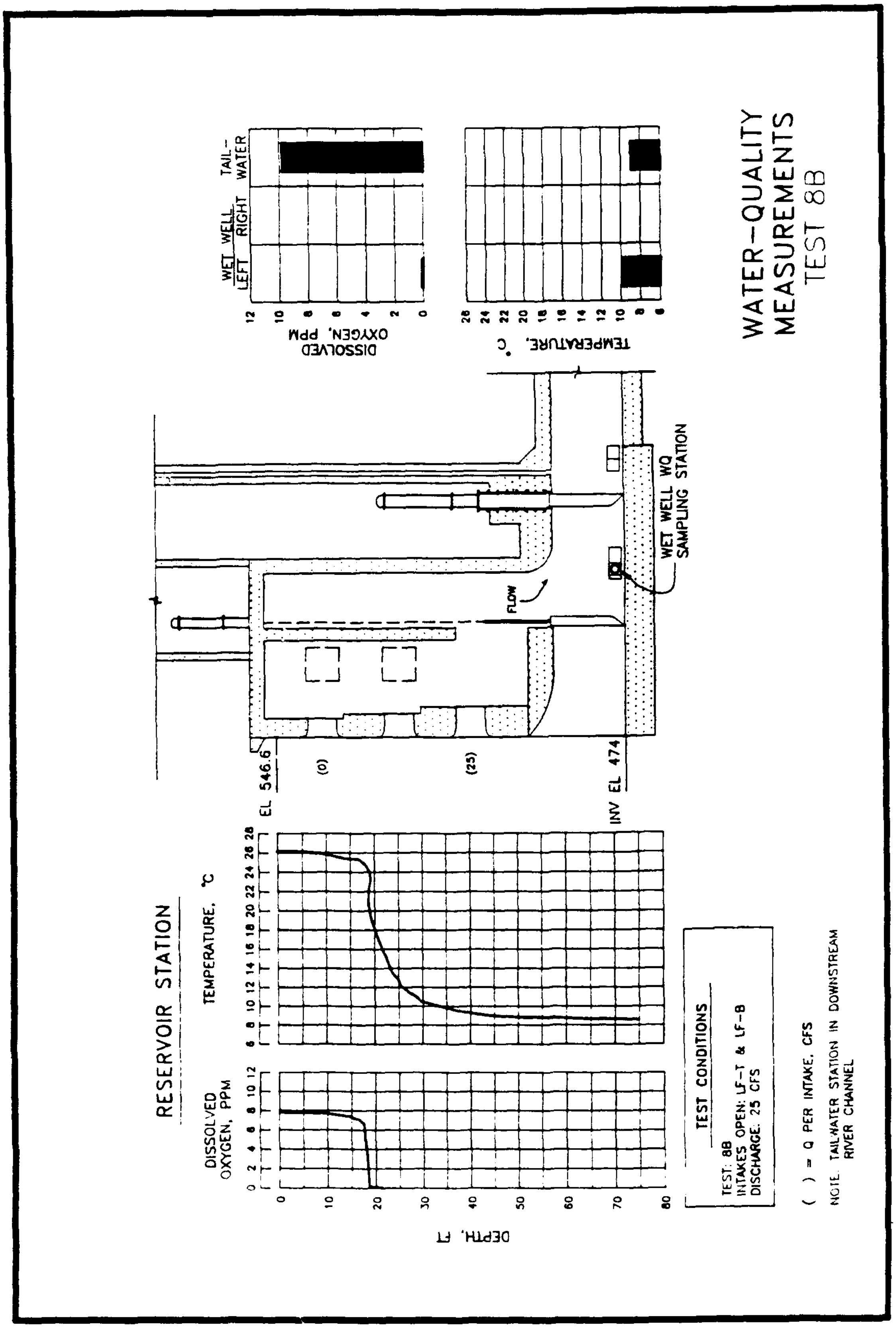
TEST CONDITIONS

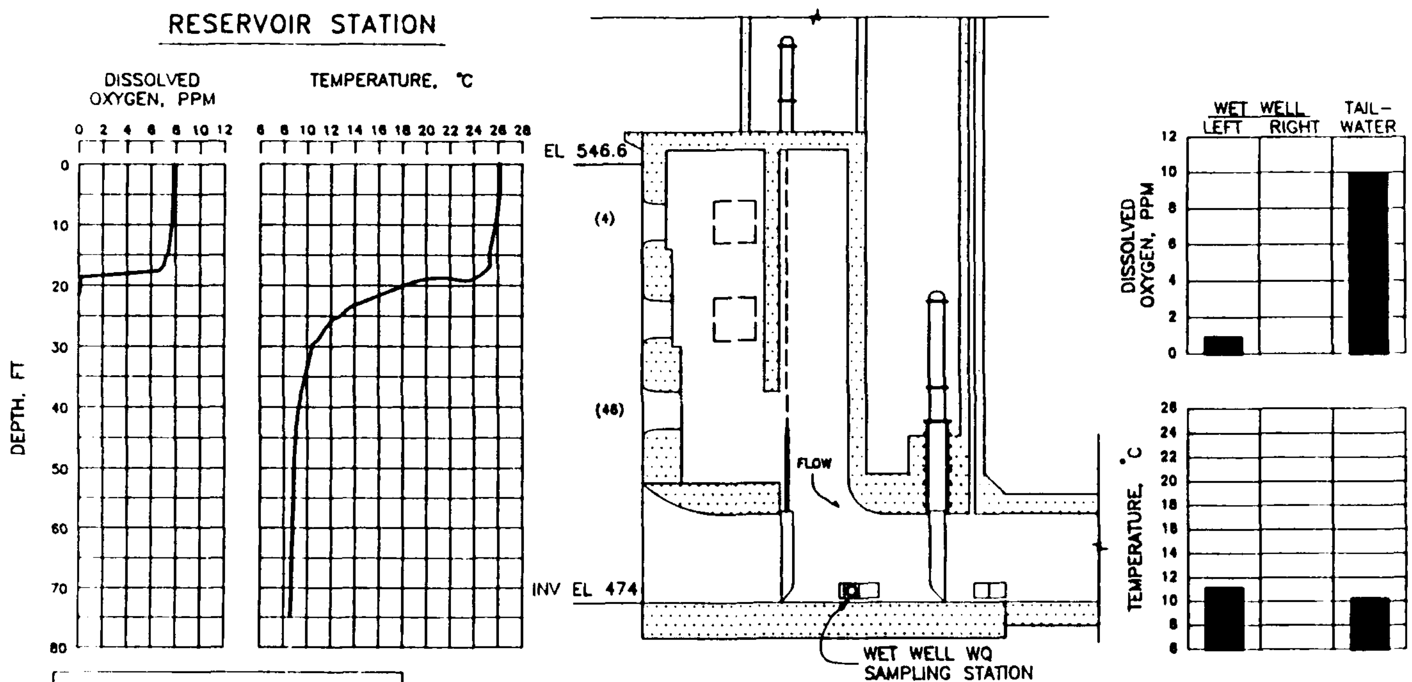
TEST: 8A
INTAKES OPEN: LF-T & LF-B
DISCHARGE: 10 CFS

( ) = Q PER INTAKE, CFS

NOTE TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

WATER-QUALITY MEASUREMENTS
TEST 8A


WATER-QUALITY MEASUREMENTS
TEST 8B
RESERVOIR STATION
DISSOLVED OXYGEN, PPM
TEMPERATURE, °C
DEPTH, FT
EL 546.6
INV EL 474
(0)
(25)
FLOW
WET WELL WQ SAMPLING STATION
WET WELL
LEFT
RIGHT
TAIL-WATER
TEST CONDITIONS
TEST: 8B
INTAKES OPEN: LF-T & LF-B
DISCHARGE: 25 CFS
( ) = Q PER INTAKE, CFS
NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL



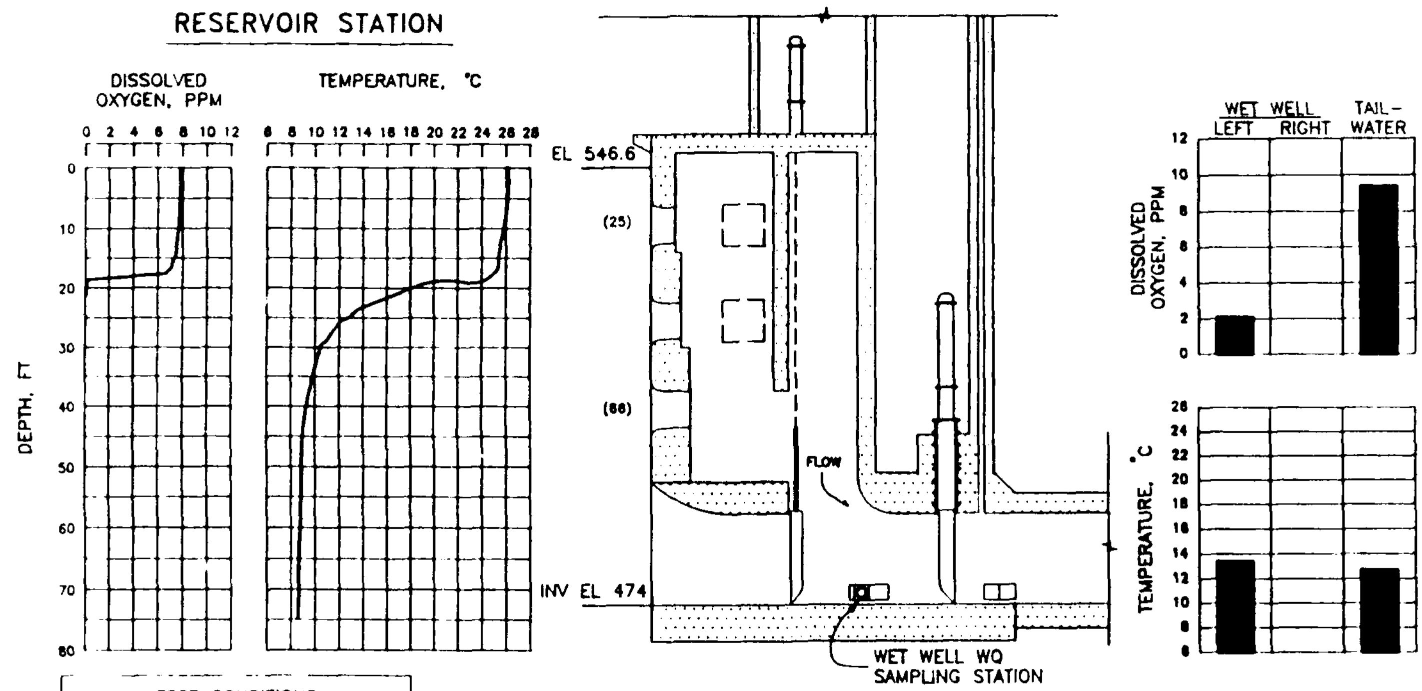
TEST CONDITIONS

TEST: 8C
INTAKES OPEN: LF-T & LF-B
DISCHARGE: 50 CFS

( ) = Q PER INTAKE, CFS

NOTE TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

WATER-QUALITY MEASUREMENTS
TEST 8C



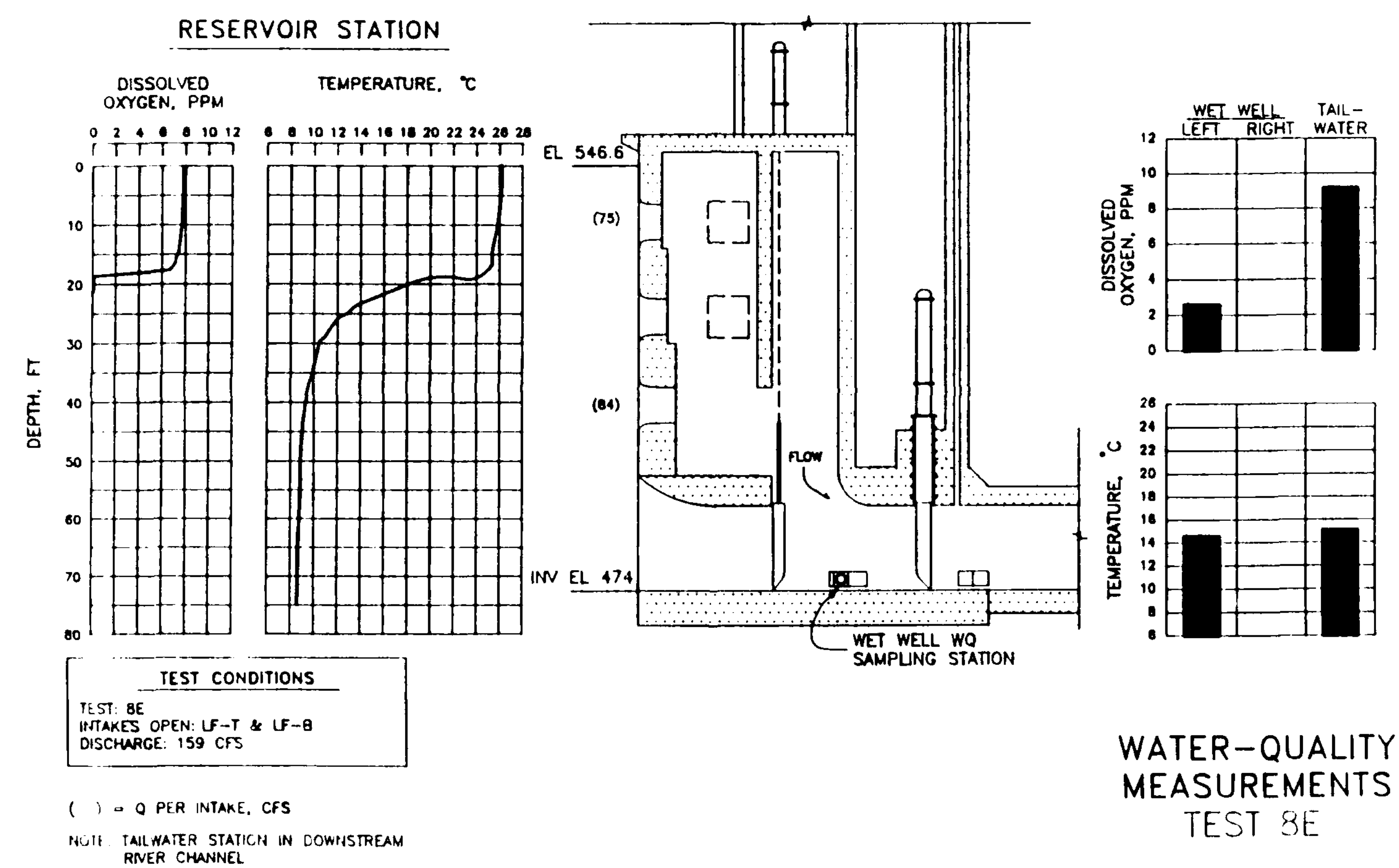
TEST CONDITIONS

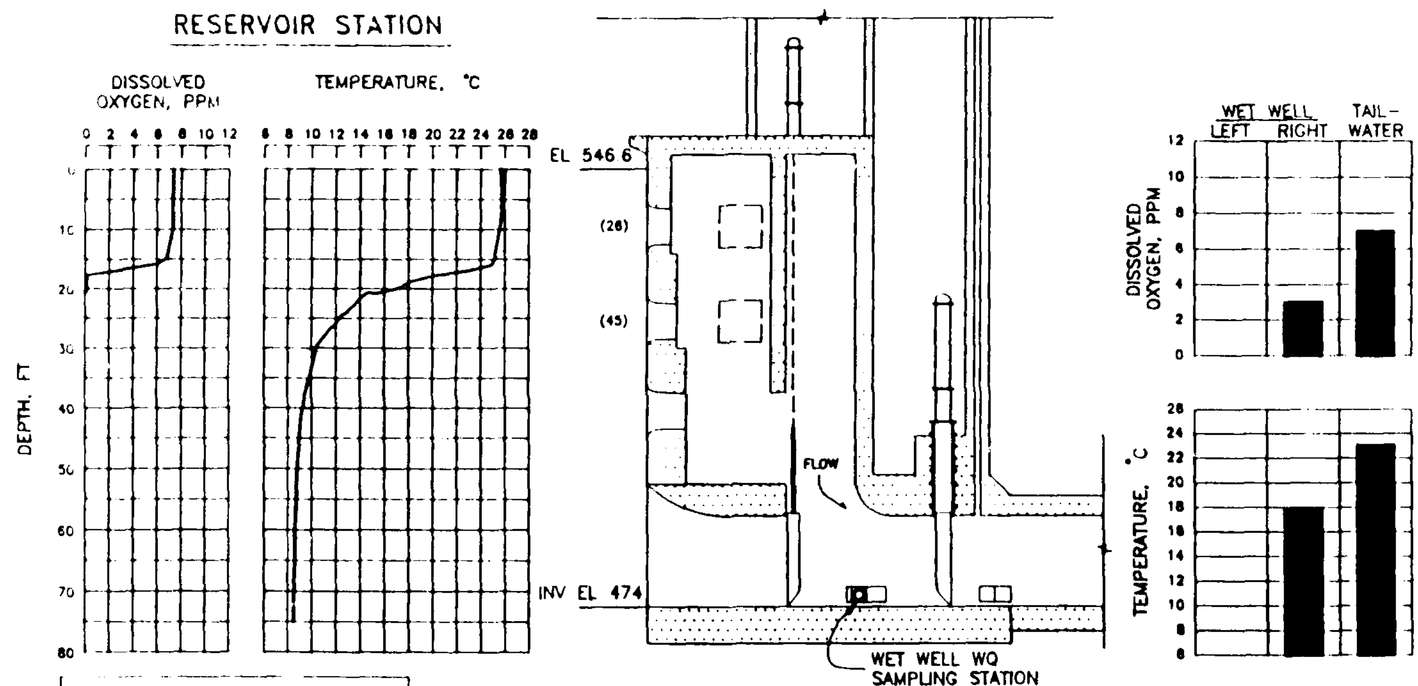
TEST: 8D
INTAKES OPEN: LF-T & LF-B
DISCHARGE: 91 CFS

( ) = Q PER INTAKE, CFS

NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

WATER-QUALITY MEASUREMENTS
TEST 8D


RESERVOIR STATION
DISSOLVED OXYGEN, PPM
TEMPERATURE, °C
DEPTH, FT
EL 546.6
(75)
(84)
INV EL 474
FLOW
WET WELL WQ SAMPLING STATION
WET WELL
LEFT
RIGHT
TAIL-WATER
DISSOLVED OXYGEN, PPM
TEMPERATURE, °C
TEST CONDITIONS
TEST: 8E
INTAKES OPEN: LF-T & LF-B
DISCHARGE: 159 CFS
( ) = Q PER INTAKE, CFS
NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL
WATER-QUALITY MEASUREMENTS
TEST 8E



TEST CONDITIONS

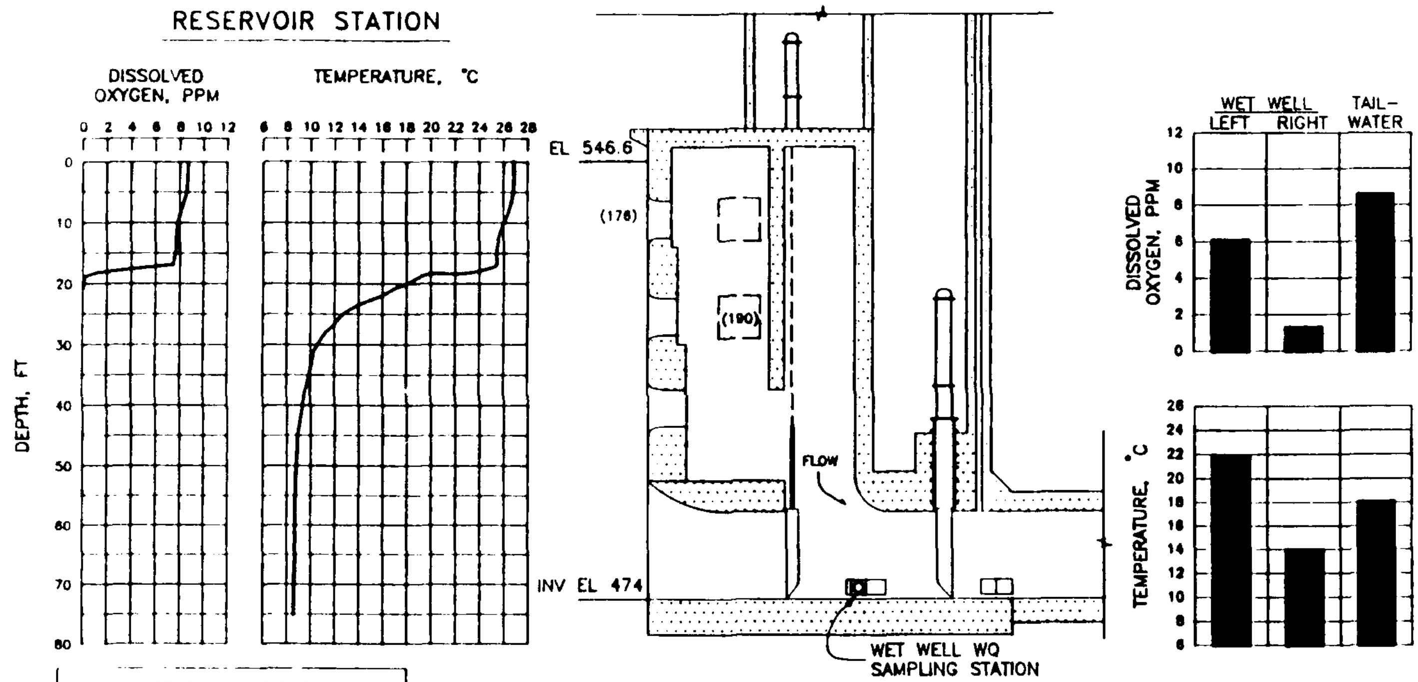
TEST 10
INTAKES OPEN: RF-T & RF-M
DISCHARGE: 71 CFS

( ) = Q PER INTAKE, CFS

NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

WATER-QUALITY MEASUREMENTS
TEST 10

RESERVOIR STATION



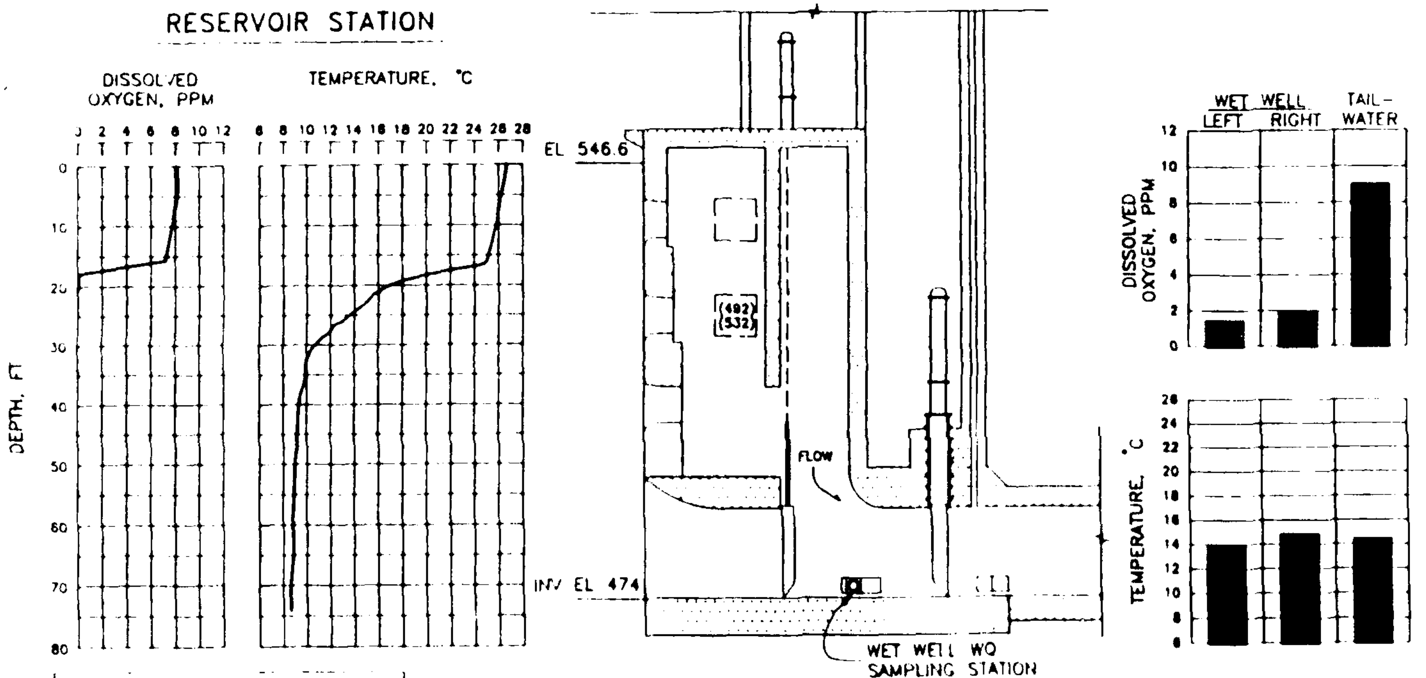
TEST CONDITIONS

TEST: 11
INTAKES OPEN: LF-T & RS-M
DISCHARGE 366 CFS

( ) = Q PER INTAKE, CFS

NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

WATER-QUALITY MEASUREMENTS
TEST 11



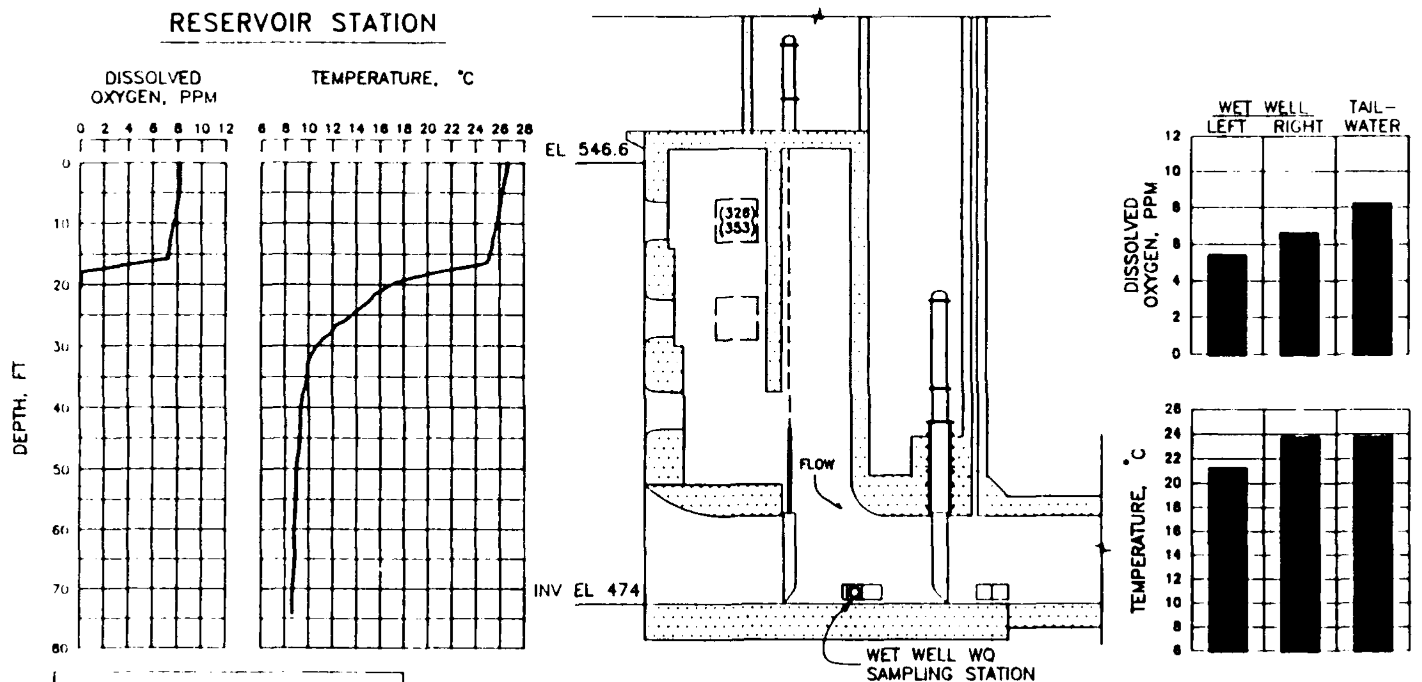
TEST CONDITIONS

TEST: 12
INTAKES OPEN: LS-M & RS-M
DISCHARGE: 1024 CFS

( ) = Q PER INTAKE, CFS

NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

WATER-QUALITY MEASUREMENTS TEST 12



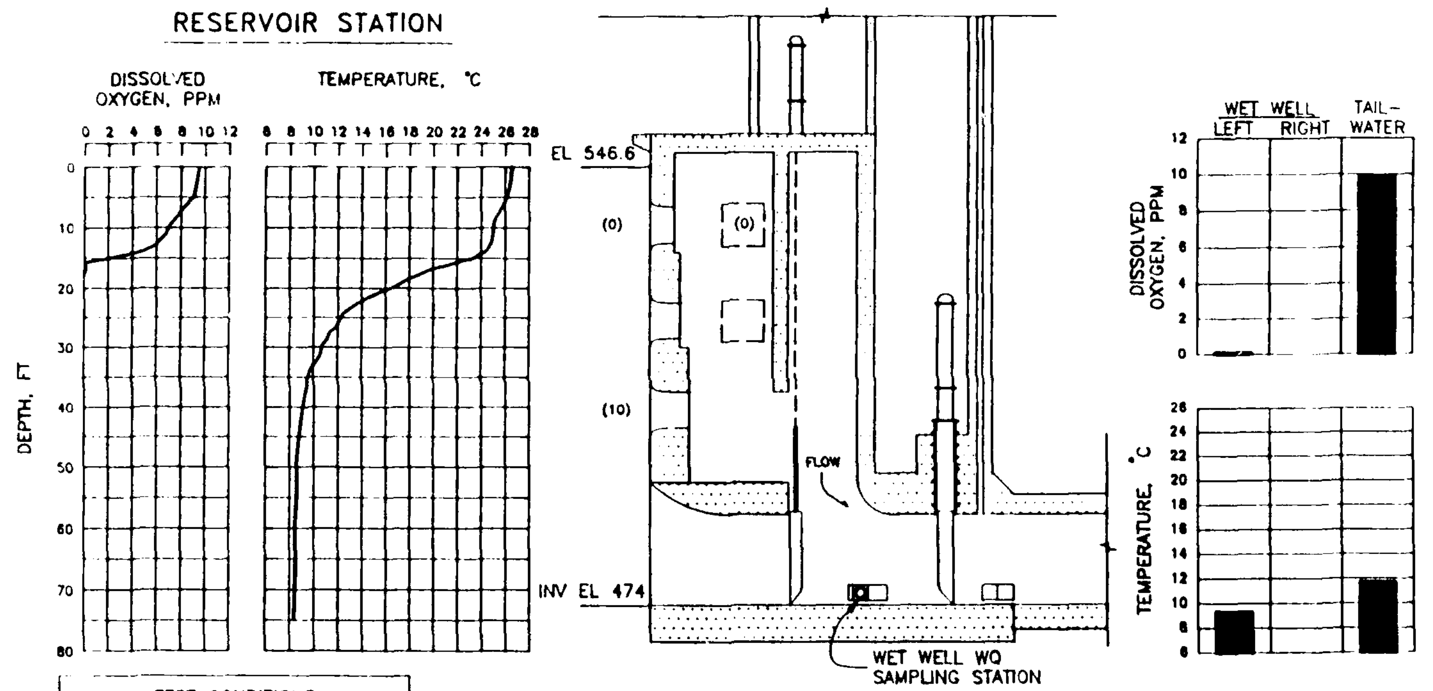
TEST CONDITIONS

TEST: 13
INTAKES OPEN: LS-T & RS-T
DISCHARGE: 679 CFS

( ) = Q PER INTAKE, CFS

NOTE. TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

WATER-QUALITY MEASUREMENTS
TEST 13



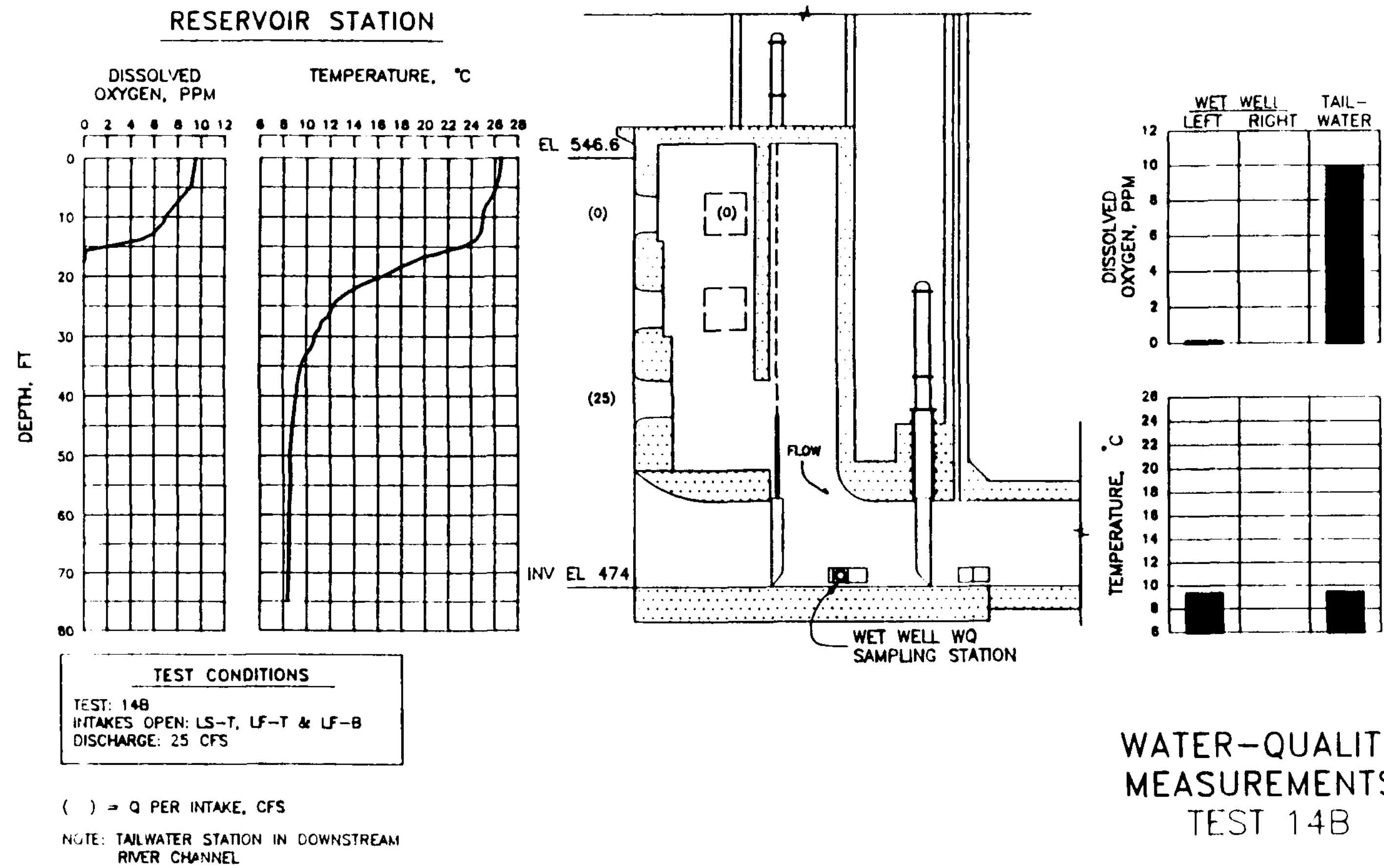
TEST CONDITIONS

TEST: 14A
INTAKES OPEN: LS-T, LF-T & LF-B
DISCHARGE: 10 CFS

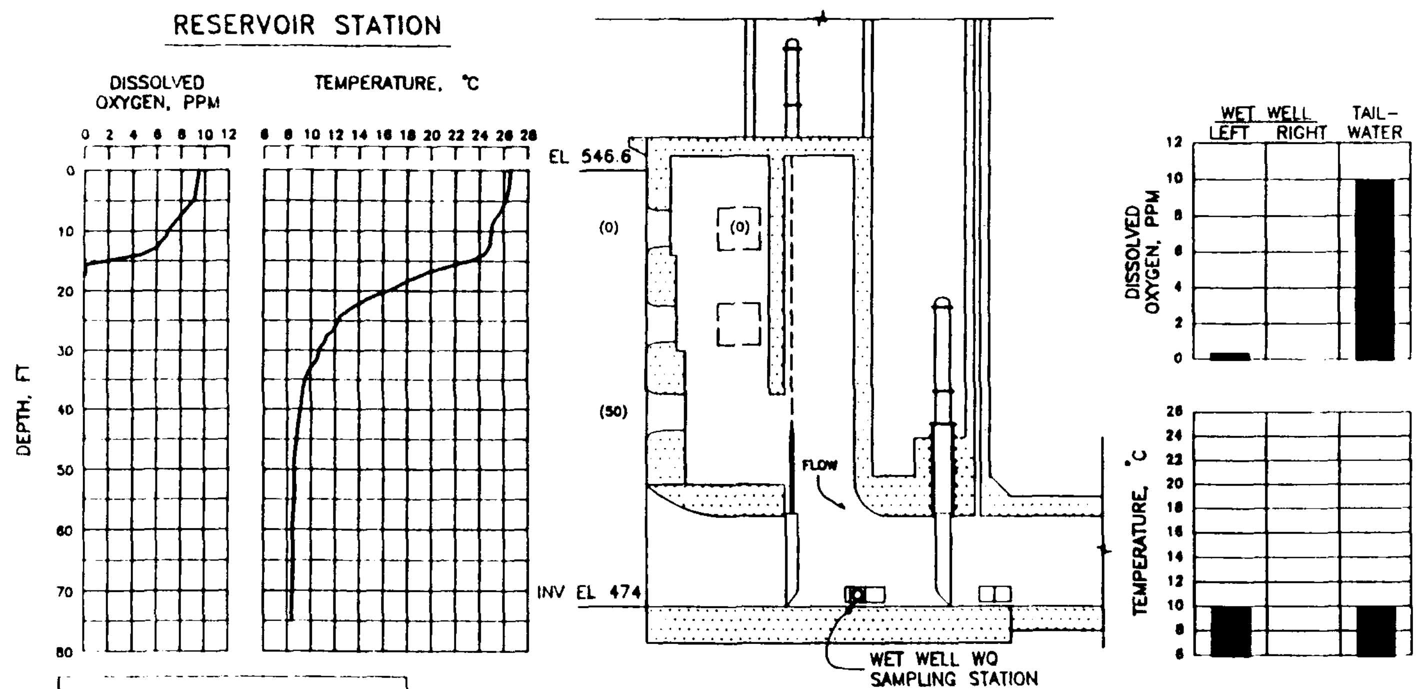
( ) = Q PER INTAKE, CFS

NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

WATER-QUALITY MEASUREMENTS
TEST 14A



WATER-QUALITY MEASUREMENTS
TEST 14B



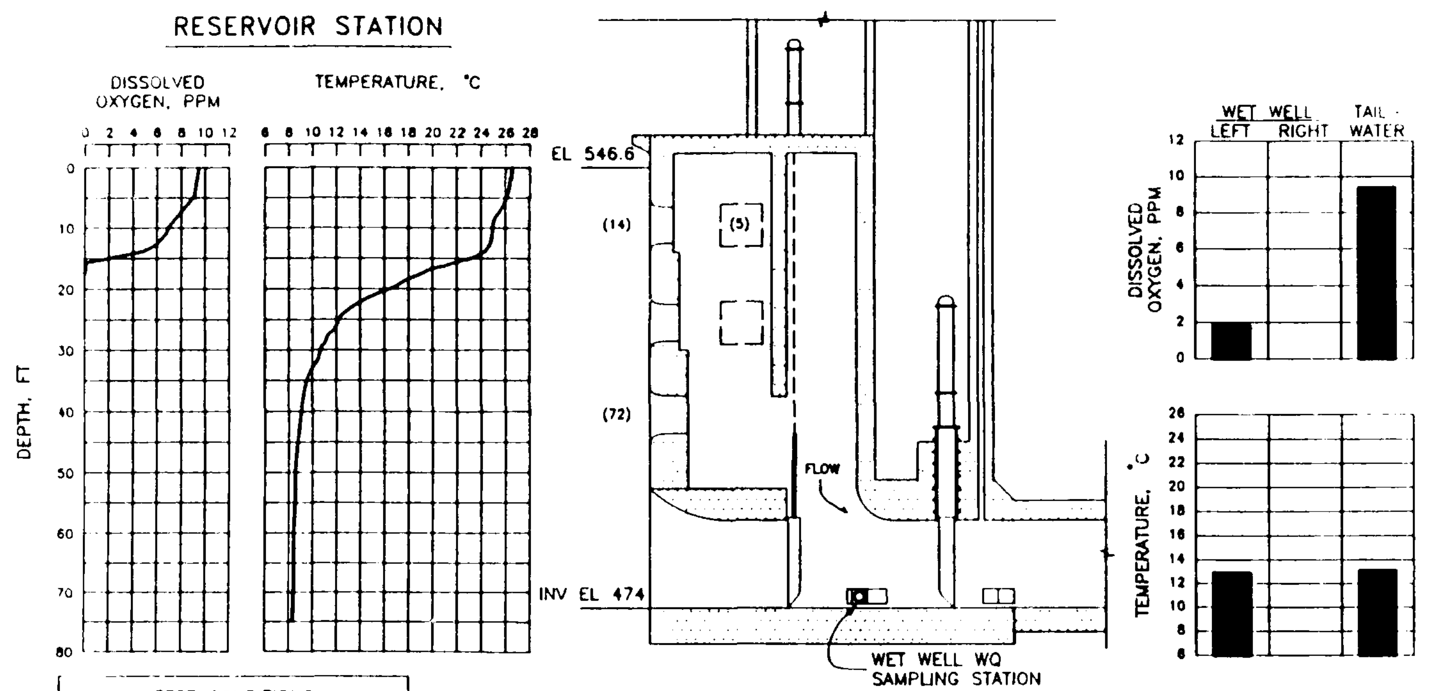
TEST CONDITIONS

TEST: 14C
INTAKES OPEN: LS-T, LF-T & LF-B
DISCHARGE: 50 CFS

( ) = Q PER INTAKE, CFS

NOTE. TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

WATER-QUALITY MEASUREMENTS
TEST 14C



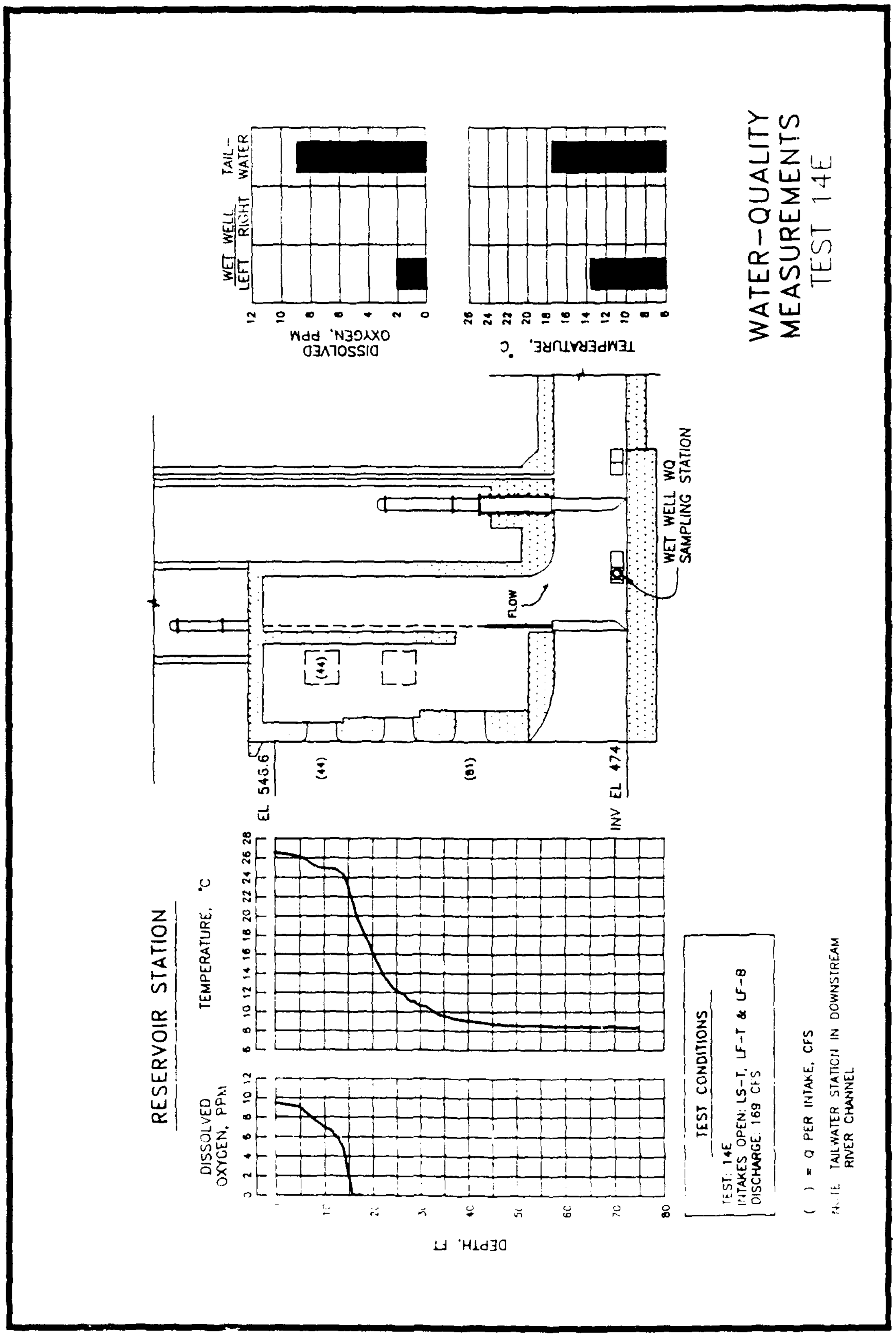
TEST CONDITIONS

TEST: 14D
INTAKES OPEN: LS-T, LF-T & LF-B
DISCHARGE 91 CFS

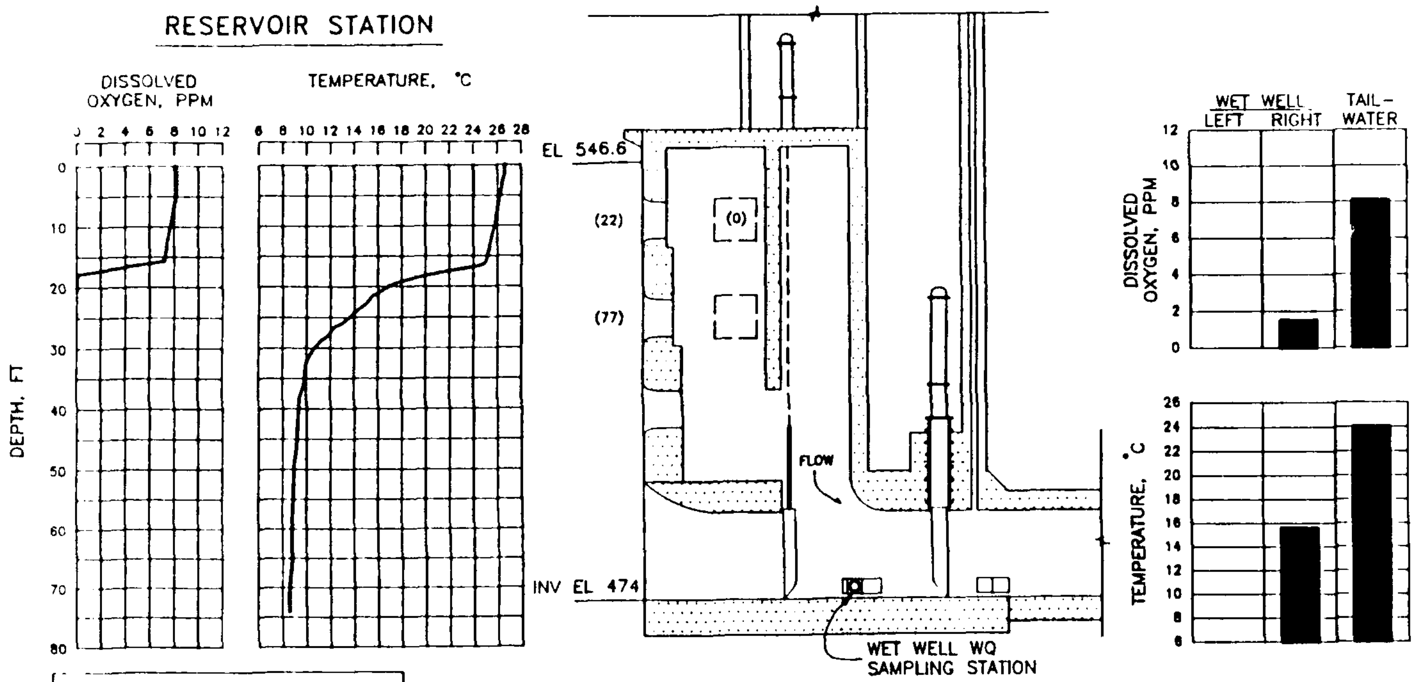
( ) = Q PER INTAKE, CFS

NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL.

WATER-QUALITY MEASUREMENTS
TEST 14D



RESERVOIR STATION
DISSOLVED OXYGEN, PPM
TEMPERATURE, °C
DEPTH, FT
EL 545.6
(44)
(81)
INV EL 474
FLOW
WET WELL WQ SAMPLING STATION
DISSOLVED OXYGEN, PPM
TEMPERATURE, °C
WET WELL
LEFT
RIGHT
TAIL-WATER
WATER-QUALITY MEASUREMENTS
TEST 14E
TEST CONDITIONS
TEST: 14E
INTAKES OPEN: LS-T, LF-T & LF-8
DISCHARGE: 169 CFS
( ) = Q PER INTAKE, CFS
NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL



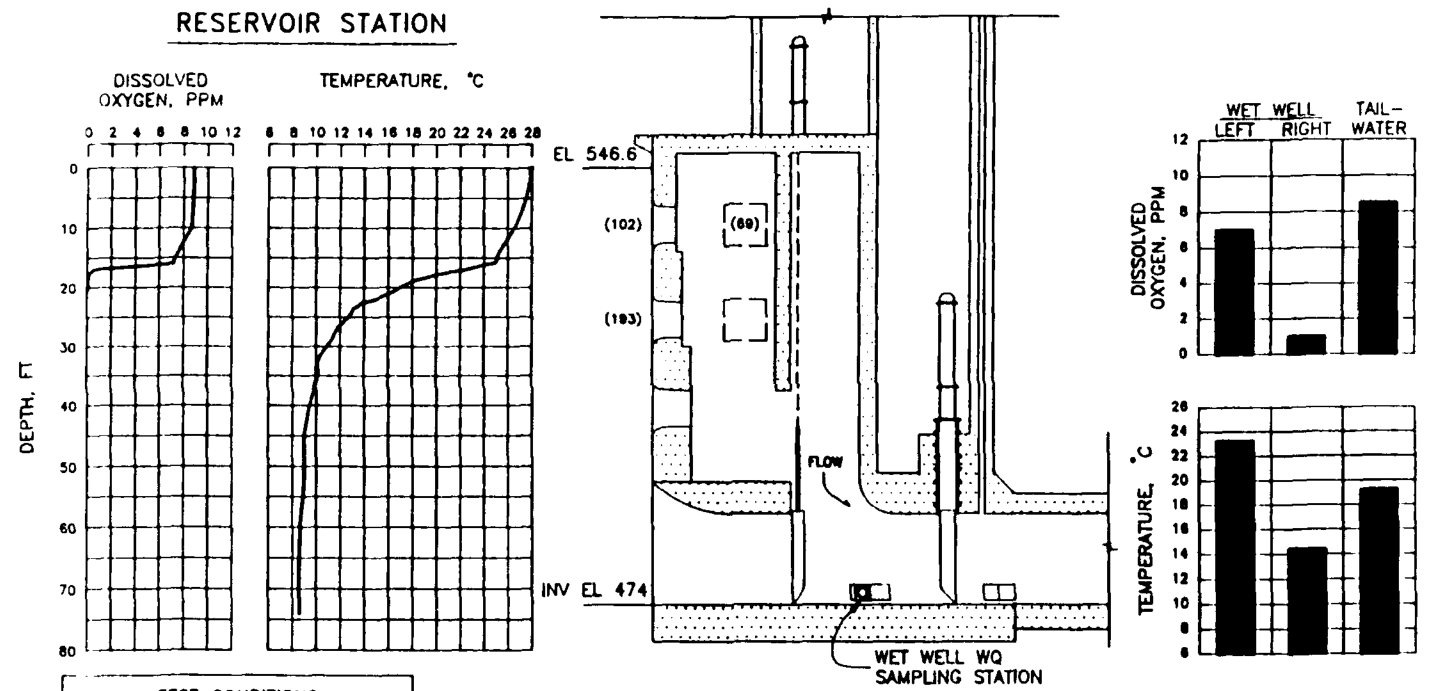
TEST CONDITIONS

TEST: 15
INTAKES OPEN: RS-T, RF-T & RF-M
DISCHARGE: 99 CFS

( ) = Q PER INTAKE, CFS

NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

WATER-QUALITY MEASUREMENTS
TEST 15



TEST CONDITIONS

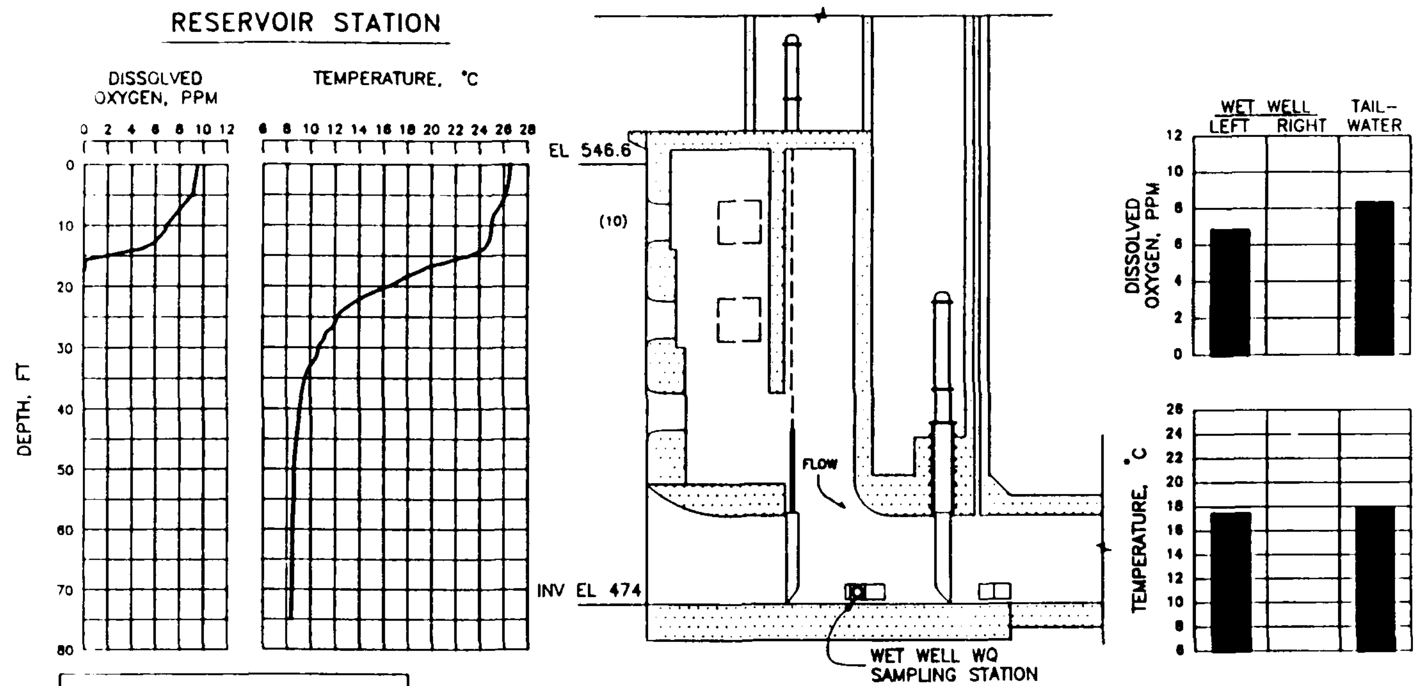
TEST: 16
INTAKES OPEN: LS-T, LF-T & RF-M
DISCHARGE: 364 CFS

( ) = Q PER INTAKE, CFS

NOTE: TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

WATER-QUALITY MEASUREMENTS
TEST 16

RESERVOIR STATION



TEST CONDITIONS

TEST: 17
INTAKES OPEN: LF-T
DISCHARGE: 10 CFS

( ) = Q PER INTAKE, CFS

NOTE. TAILWATER STATION IN DOWNSTREAM RIVER CHANNEL

WATER-QUALITY MEASUREMENTS
TEST 17

TOTAL Q = 488 CFS

LEFT WET WELL		RIGHT WET WELL	
SIDE INTAKES	FRONT INTAKES	FRONT INTAKES	SIDE INTAKES

EL 534

SIDE INTAKES (LEFT WET WELL)

-	-	-
-	-	-
-	-	-

QE =

FRONT INTAKES (LEFT WET WELL)

6.3 -13.4	5.9 -5.1	5.3 8.7
6.5 -19.6	6.1 -0.9	5.5 14.2
6.2 -14.7	5.9 -9.5	5.2 8.8

QE = 225

FRONT INTAKES (RIGHT WET WELL)

7.1 -19.1	6.7 -3.6	6.7 10.8
7.4 -14.9	6.8 7.8	6.9 19.0
7.0 -17.0	6.9 4.2	6.0 13.2

QE = 264

SIDE INTAKES (RIGHT WET WELL)

-	-	-
-	-	-
-	-	-

QE =

EL 518

-	-	-
-	-	-
-	-	-

QE =

-	-	-
-	-	-
-	-	-

QE =

-	-	-
-	-	-
-	-	-

QE =

-	-	-
-	-	-
-	-	-

QE =

EL 503

-	-	-
-	-	-
-	-	-

QE =

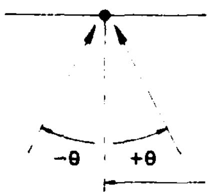
-	-	-
-	-	-
-	-	-

QE =

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG θ	-
-	-



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 1

TOTAL Q = 252 CFS

LEFT WET WELL

SIDE INTAKES

-	-	-
-	-	-
-	-	-

EL 534
QE = ________

-	-	-
-	-	-
-	-	-

EL 518
QE = ________

FRONT INTAKES

-	-	-
-	-	-
-	-	-

QE = ________

-	-	-
-	-	-
-	-	-

QE = ________

-	-	-
-	-	-
-	-	-

EL 503
QE = ________

RIGHT WET WELL

FRONT INTAKES

7.1 -18.3	6.4 0	6.5 15.9
7.4 -26.5	6.5 0	7.0 18.3
7.4 -18.0	6.7 1.3	6.7 12.5

QE = 252

-	-	-
-	-	-
-	-	-

QE = ________

-	-	-
-	-	-
-	-	-

QE = ________

SIDE INTAKES

-	-	-
-	-	-
-	-	-

QE = ________

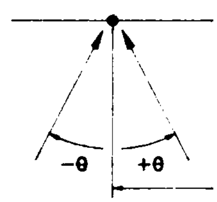
-	-	-
-	-	-
-	-	-

QE = ________

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG θ	-
-	-



VELOCITY VECTOR ORIENTATION

PERPENDICULAR TO INTAKE PLANE

INTAKE VELOCITY MEASUREMENTS
TEST 2

TOTAL Q = 340 CFS

LEFT WET WELL

EL 534

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

4.4	4.1	3.9
–12.9	–8.3	9.2
4.4	4.0	4.0
–19.1	–6.2	18.8
4.2	3.9	3.7
–7.2	–1.7	12.5

QE = 167

EL 518

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

EL 503

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

RIGHT WET WELL

EL 534

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

EL 518

FRONT INTAKES

4.5	3.8	4.4
–18.7	–2.2	16.0
4.7	4.0	4.5
–23.3	–1.0	21.5
4.4	4.0	4.1
–15.5	–2.8	17.0

QE = 173

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

EL 503

FRONT INTAKES

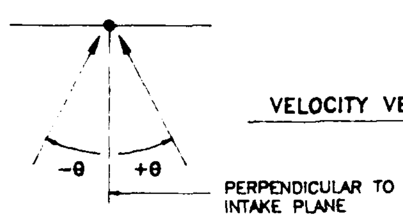
–	–	–
–	–	–
–	–	–

QE =

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–
–	–



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 3

TOTAL Q = 360 CFS

LEFT WET WELL

EL 534

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

EL 518

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

EL 503

FRONT INTAKES

4.0 / –11.8	3.7 / –4.8	3.2 / 12.1
4.6 / –15.6	3.9 / 7.8	3.7 / 9.5
4.3 / –14.4	3.8 / –5.8	3.[illegible] / 10.1

QE = 176

RIGHT WET WELL

EL 534

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

EL 518

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

EL 503

FRONT INTAKES

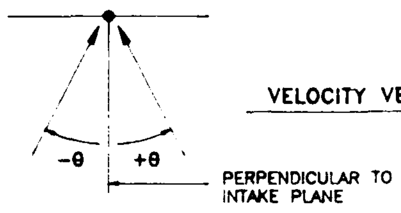
3.7 / –13.7	3.4 / 7.3	3.8 / 16.8
4.5 / –18.2	3.9 / 0	4.5 / 20.5
4.3 / –15.3	3.8 / 0	4.3 / 20.6

QE = 183

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–	
–	–	



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 5

TOTAL Q = 992 CFS

LEFT WET WELL

SIDE INTAKES (EL 534)

–	–	–
–	–	–
–	–	–

EL 534
QE = ______

FRONT INTAKES

5.3	5.1	5.2
−11.2	−2.3	14.5
5.4	5.1	4.9
−18.2	−10.3	10.5
5.2	4.9	4.7
−16.2	−10.1	5.5

QE = 228

SIDE INTAKES (EL 518)

–	–	–
–	–	–
–	–	–

EL 518
QE = ______

FRONT INTAKES

6.5	6.1	5.8
−13.0	−12.4	9.2
6.8	6.1	6.0
−14.0	−5.3	12.8
6.4	5.8	5.8
−13.6	−4.4	10.5

QE = 268

FRONT INTAKES (EL 503)

–	–	–
–	–	–
–	–	–

EL 503
QE = ______

RIGHT WET WELL

FRONT INTAKES

5.5	5.2	5.3
−13.3	4.7	15.6
5.5	4.9	5.5
−23.6	0.6	18.4
4.4	4.9	3.9
20.3	2.3	3.2

QE = 218

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

FRONT INTAKES

6.5	5.8	6.5
−13.6	4.3	14.0
6.9	5.9	6.9
−19.5	0.8	16.4
6.6	6.0	6.7
−17.9	2.0	14.1

QE = 278

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

FRONT INTAKES

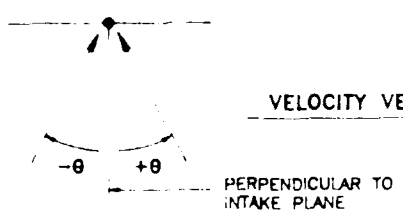
–	–	–
–	–	–
–	–	–

QE = ______

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–	
–	–	



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 6

TOTAL Q = 617 CFS

LEFT WET WELL

SIDE INTAKES

–	–	–
–	–	–
–	–	–

EL 534
QE =

–	–	–
–	–	–
–	–	–

EL 518
QE =

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

8.3 −16.4	7.5 −8.3	6.8 14.1
8.7 −21.7	8.0 −8.9	7.3 11.6
8.4 −15.9	8.0 −8.5	7.3 8.3

QE = 309

–	–	–
–	–	–
–	–	–

EL 503
QE =

RIGHT WET WELL

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

7.6 −19.0	7.3 2.1	5.3 13.9
8.6 −14.7	8.2 3.7	8.0 17.3
8.6 −15.9	7.7 3.0	7.8 10.5

QE = 308

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

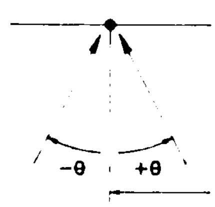
–	–	–
–	–	–
–	–	–

QE =

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG θ	–
–	–



VELOCITY VECTOR ORIENTATION

PERPENDICULAR TO INTAKE PLANE

INTAKE VELOCITY MEASUREMENTS
TEST 7

TOTAL Q = 10 CFS

LEFT WET WELL

EL 534

SIDE INTAKES

-	-	-
-	-	-
-	-	-

QE =

FRONT INTAKES

0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0

QE = 0

EL 518

SIDE INTAKES

-	-	-
-	-	-
-	-	-

QE =

FRONT INTAKES

-	-	-
-	-	-
-	-	-

QE =

EL 503

FRONT INTAKES

0.3 / -28.8	0.4 / -37.6	0.4 / 34.7
0.5 / -47.1	0.5 / -38.7	0.5 / 44
0.4 / -40.8	0.4 / -40.7	0.4 / 41.0

QE = 10

RIGHT WET WELL

EL 534

FRONT INTAKES

-	-	-
-	-	-
-	-	-

QE =

SIDE INTAKES

-	-	-
-	-	-
-	-	-

QE =

EL 518

FRONT INTAKES

-	-	-
-	-	-
-	-	-

QE =

SIDE INTAKES

-	-	-
-	-	-
-	-	-

QE =

EL 503

FRONT INTAKES

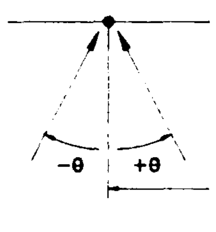
-	-	-
-	-	-
-	-	-

QE =

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	-
-	-



VELOCITY VECTOR ORIENTATION

PERPENDICULAR TO INTAKE PLANE

INTAKE VELOCITY MEASUREMENTS
TEST 8A

TOTAL Q = 25 CFS

LEFT WET WELL

SIDE INTAKES

EL 534

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0

QE = 0

SIDE INTAKES

EL 518

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

EL 503

0.8 / 8.9	0.8 / −1.8	0.7 / 41.0
1.0 / −27.9	0.9 / −11.3	0.7 / 0
1.0 / −26.7	0.9 / −9.5	0.7 / 4.8

QE = 25

RIGHT WET WELL

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

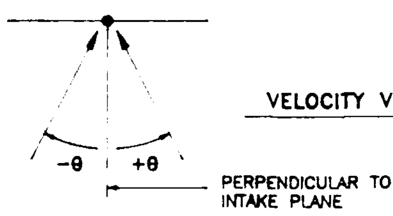
–	–	–
–	–	–
–	–	–

QE =

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–
–	–



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 8B

TOTAL Q = 50 CFS

LEFT WET WELL

SIDE INTAKES

EL 534

–	–	–
–	–	–
–	–	–

QE =

EL 518

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

0.2 / −58.2	0.1 / −37.2	0.1 / −65.1
0.3 / −49.1	0.1 / −33.7	0.1 / −65.1
0 / 0	0.1 / 14.2	0 / 0

QE = 4

–	–	–
–	–	–
–	–	–

QE =

EL 503

1.1 / −18.2	1.1 / −6.5	0.9 / 3.9
1.3 / −22.5	1.1 / −9.7	1.0 / 0
1.3 / −18.9	1.1 / −4.9	1.0 / 3.5

QE = 46

RIGHT WET WELL

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

–	–	–
–	–	–
–	–	–

QE =

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

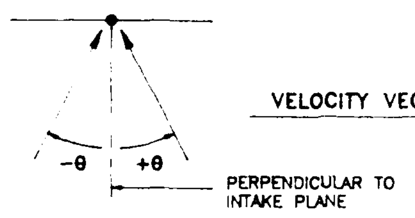
–	–	–
–	–	–
–	–	–

QE =

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–
–	–



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 8C

TOTAL Q = 159 CFS

LEFT WET WELL

SIDE INTAKES

EL 534

–	–	–
–	–	–
–	–	–

QE = ______

FRONT INTAKES

0.7 / –19.2	0.5 / –25.4	0.3 / –33.2
0.6 / –32.6	0.4 / –16.5	0.3 / –10.4
0.8 / –24.3	0.5 / –20.2	0.5 / 13.6

QE = 25

EL 518

SIDE INTAKES:

–	–	–
–	–	–
–	–	–

QE = ______

FRONT INTAKES:

–	–	–
–	–	–
–	–	–

QE = ______

EL 503

FRONT INTAKES:

1.3 / –15.7	1.2 / –1.2	1.0 / 0
1.5 / –22.6	1.3 / –10.7	1.2 / 0
1.5 / –18.5	1.3 / –4.3	1.1 / 3.1

QE = 66

RIGHT WET WELL

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

FRONT INTAKES:

–	–	–
–	–	–
–	–	–

QE = ______

SIDE INTAKES:

–	–	–
–	–	–
–	–	–

QE = ______

FRONT INTAKES:

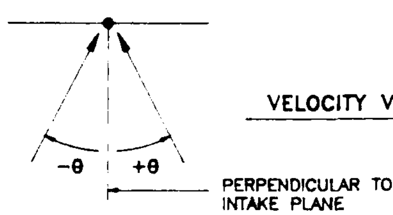
–	–	–
–	–	–
–	–	–

QE = ______

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–	
–	–	



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 8D

TOTAL Q = 159 CFS

LEFT WET WELL

SIDE INTAKES

–	–	–
–	–	–
–	–	–

EL 534
QE =

FRONT INTAKES

2.0 / −31.6	1.7 / −12.3	1.4 / −2.6
2.0 / −25.8	1.7 / −8.1	1.6 / 17.9
1.7 / 8.4	1.8 / −6.8	1.5 / 4.6

QE = 75

SIDE INTAKES

–	–	–
–	–	–
–	–	–

EL 518
QE =

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

2.0 / −11.2	1.9 / −4.3	1.7 / 8.5
1.9 / −11.8	2.1 / −5.1	1.5 / −6.9
2.2 / −13.8	2.1 / −4.0	1.9 / 5.7

EL 503
QE = 84

RIGHT WET WELL

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

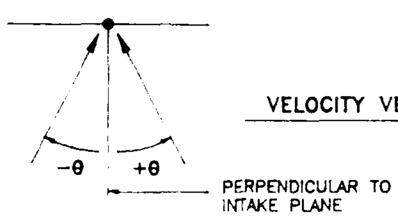
–	–	–
–	–	–
–	–	–

QE =

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–
–	–



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 8E

TOTAL Q = 147 CFS

LEFT WET WELL

SIDE INTAKES

-	-	-
-	-	-
-	-	-

EL 534
QE =

FRONT INTAKES

1.9 -5.5	1.8 -0.8	1.6 2.3
2.4 -20.9	1.9 -16.7	1.5 -2.4
2.1 -15.8	1.9 1.4	1.6 6.9

QE = 78

SIDE INTAKES

-	-	-
-	-	-
-	-	-

EL 518
QE =

FRONT INTAKES

-	-	-
-	-	-
-	-	-

QE =

FRONT INTAKES

-	-	-
-	-	-
-	-	-

EL 503
QE =

RIGHT WET WELL

FRONT INTAKES

-	-	-
-	-	-
-	-	-

QE =

SIDE INTAKES

-	-	-
-	-	-
-	-	-

QE =

FRONT INTAKES

1.8 -16.1	1.6 0	1.6 6.3
2.0 -24.5	1.7 0	1.7 14.6
1.8 -13.2	1.7 0	1.6 4.1

QE = 69

SIDE INTAKES

-	-	-
-	-	-
-	-	-

QE =

FRONT INTAKES

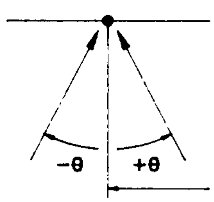
-	-	-
-	-	-
-	-	-

QE =

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG θ	-
-	-



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 9

TOTAL Q = 71 CFS

LEFT WET WELL

SIDE INTAKES

EL 534

–	–	–
–	–	–
–	–	–

QE = ____

EL 518

–	–	–
–	–	–
–	–	–

QE = ____

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE = ____

–	–	–
–	–	–
–	–	–

QE = ____

EL 503

–	–	–
–	–	–
–	–	–

QE = ____

RIGHT WET WELL

FRONT INTAKES

0.7 / −7.8	0.8 / 1.8	0.6 / 19.3
0.9 / −19.8	0.8 / −9.2	0.5 / 15.7
0.8 / −26.3	0.7 / 3.8	0.6 / 12.7

QE = 26

1.8 / −31.7	0.9 / −22.5	–
1.2 / −4.8	1.1 / 7.6	1.0 / 14.2
1.2 / −18.3	1.1 / 0	1.0 / 8.2

QE = 45

–	–	–
–	–	–
–	–	–

QE = ____

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE = ____

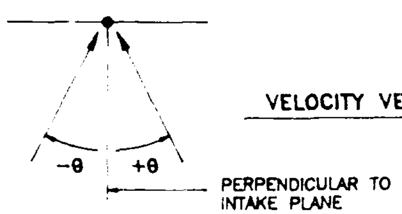
–	–	–
–	–	–
–	–	–

QE = ____

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–
–	–



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 10

TOTAL Q = 366 CFS

LEFT WET WELL

SIDE INTAKES

–	–	–
–	–	–
–	–	–

EL 534

QE =

FRONT INTAKES

4.3 / −17.3	3.9 / −3.1	3.6 / 10.9
4.5 / −17.0	4.0 / −5.5	4.0 / 15.0
4.3 / −7.2	4.1 / −6.4	3.9 / 7.3

QE = 176

SIDE INTAKES

–	–	–
–	–	–
–	–	–

EL 518

QE =

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

–	–	–
–	–	–
–	–	–

EL 503

QE =

RIGHT WET WELL

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

4.5 / −22.3	4.1 / −6.0	4.1 / 13.4
5.0 / −23.7	4.3 / −6.2	4.5 / 15.4
4.9 / −13.2	4.4 / 4.7	4.4 / 14.2

QE = 190

FRONT INTAKES

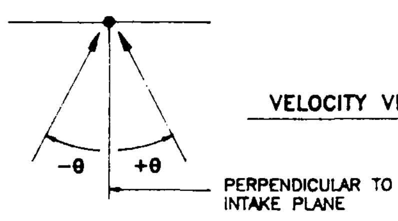
–	–	–
–	–	–
–	–	–

QE =

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–
–	–



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 11

TOTAL Q = 1024 CFS

LEFT WET WELL

EL 534

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

EL 518

SIDE INTAKES

11.1 / −12.0	10.3 / −4.9	10.6 / 10.0
11.8 / −15.7	9.9 / −1.9	11.2 / 13.4
11.6 / −15.6	9.9 / −3.9	11.0 / 12.3

QE = 492

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

EL 503

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

RIGHT WET WELL

EL 534

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

EL 518

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

SIDE INTAKES

12.0 / −18.4	10.5 / 0.5	11.5 / 14.3
12.5 / −18.0	11.2 / 2.1	12.0 / 16.2
12.7 / −17.6	11.1 / 1.1	11.8 / 14.6

QE = 532

EL 503

FRONT INTAKES

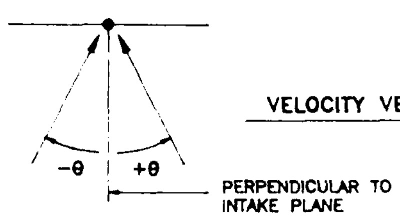
–	–	–
–	–	–
–	–	–

QE = ______

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–
–	–



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 12

TOTAL Q = 679 CFS

LEFT WET WELL

SIDE INTAKES

7.1 / −14.2	7.3 / −8.4	6.4 / 11.8
8.4 / −19.1	8.0 / −7.1	7.5 / 15.4
8.4 / −12.0	8.1 / −6.0	7.4 / 12.2

EL 534
QE = 326

–	–	–
–	–	–
–	–	–

EL 518
QE =

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

–	–	–
–	–	–
–	–	–

QE =

–	–	–
–	–	–
–	–	–

EL 503
QE =

RIGHT WET WELL

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

–	–	–
–	–	–
–	–	–

QE =

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

9.1 / −13.7	7.5 / −2.2	7.4 / 15.0
8.9 / −22.7	7.8 / 1.8	8.0 / 20.7
8.6 / −19.8	7.4 / −4.9	7.8 / 15.4

QE = 353

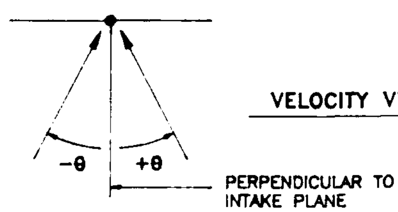
–	–	–
–	–	–
–	–	–

QE =

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–
–	–



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 13

TOTAL Q = 10 CFS

LEFT WET WELL

SIDE INTAKES

0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0

EL 534
QE = 0

–	–	–
–	–	–
–	–	–

EL 518
QE =

FRONT INTAKES

0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0

QE = 0

–	–	–
–	–	–
–	–	–

QE =

0.3 / −30.0	0.3 / −24.7	0.6 / −63.8
0.4 / −26.3	0.4 / 0	0.4 / −14.3
0.5 / −27.6	0.4 / −3.5	0.4 / −17.4

EL 503
QE = 10

RIGHT WET WELL

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

–	–	–
–	–	–
–	–	–

QE =

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

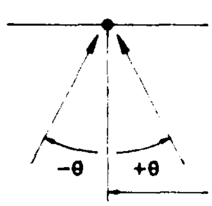
–	–	–
–	–	–
–	–	–

QE =

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–
–	–



VELOCITY VECTOR ORIENTATION

PERPENDICULAR TO INTAKE PLANE

INTAKE VELOCITY MEASUREMENTS
TEST 14A

TOTAL Q = 25 CFS

LEFT WET WELL

EL 534

SIDE INTAKES

0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0

QE = 0

FRONT INTAKES

0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0

QE = 0

EL 518

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

EL 503

FRONT INTAKES

0.7 / −21.6	0.8 / 0	0.6 / −3.1
0.8 / −18.7	0.8 / 0	0.7 / 0
0.9 / −21.3	0.8 / −3.5	0.7 / −2.4

QE = 25

RIGHT WET WELL

EL 534

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

EL 518

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE = ______

EL 503

FRONT INTAKES

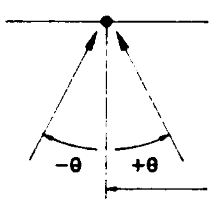
–	–	–
–	–	–
–	–	–

QE = ______

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–	
–	–	



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 14B

TOTAL Q = 50 CFS

LEFT WET WELL		RIGHT WET WELL	
SIDE INTAKES	FRONT INTAKES	FRONT INTAKES	SIDE INTAKES

EL 534

Left Wet Well – Side Intakes

0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0

QE = 0

Left Wet Well – Front Intakes

0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0

QE = 0

Right Wet Well – Front Intakes

–	–	–
–	–	–
–	–	–

QE = ______

Right Wet Well – Side Intakes

–	–	–
–	–	–
–	–	–

QE = ______

EL 518

Left Wet Well – Side Intakes

–	–	–
–	–	–
–	–	–

QE = ______

Left Wet Well – Front Intakes

–	–	–
–	–	–
–	–	–

QE = ______

Right Wet Well – Front Intakes

–	–	–
–	–	–
–	–	–

QE = ______

Right Wet Well – Side Intakes

–	–	–
–	–	–
–	–	–

QE = ______

EL 503

Left Wet Well – Front Intakes

1.0 / −23.3	0.9 / −2.9	0.9 / 0
1.3 / −16.8	1.1 / 0	1.1 / 3.2
1.2 / −20.7	1.1 / −2.5	1.0 / 1.7

QE = 50

Right Wet Well – Front Intakes

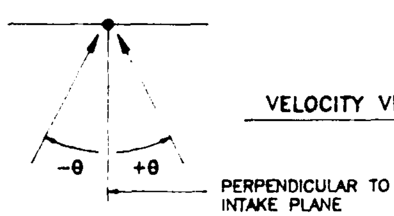
–	–	–
–	–	–
–	–	–

QE = ______

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–
–	–



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 14C

TOTAL Q = 91 CFS

LEFT WET WELL

SIDE INTAKES

0.2 / −45.2	0.2 / −38.9	0 / 0
0.3 / −45.1	0.2 / −40.0	0 / 0
0.2 / −45.0	0.2 / −18.8	0 / 0

EL 534

QE = 5

FRONT INTAKES

0.2 / −78.6	0.1 / −21.6	0.2 / −74.3
0.2 / −50.9	0.1 / −11.2	0.2 / −63.9
0.6 / −36.0	0.1 / 21.6	0 / 0

QE = 14

–	–	–
–	–	–
–	–	–

EL 518

QE =

–	–	–
–	–	–
–	–	–

QE =

1.2 / 29.9	1.2 / −12.6	2.8 / −68.0
1.4 / −19.2	1.3 / −1.1	1.2 / 1.5
1.4 / −18.8	1.3 / −2.1	1.2 / 0

EL 503

QE = 72

RIGHT WET WELL

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

–	–	–
–	–	–
–	–	–

QE =

–	–	–
–	–	–
–	–	–

QE =

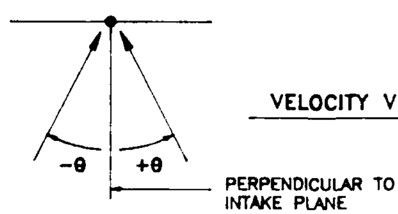
–	–	–
–	–	–
–	–	–

QE =

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–
–	–



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 14D

TOTAL Q = 169 CFS

LEFT WET WELL

SIDE INTAKES (EL 534)

0.9 / −15.5	0.8 / −6.6	0.6 / −5.6
1.1 / −29.5	0.9 / −12.7	0.8 / −9.5
1.0 / −22.7	0.9 / −3.2	0.7 / 16.6

EL 534
QE = 44

FRONT INTAKES

0.9 / −24.9	0.8 / −11.9	0.7 / −7.2
1.1 / −34.5	0.9 / 0	0.9 / 0
1.0 / −7.2	0.9 / 10.7	0.9 / 6.2

QE = 44

SIDE INTAKES (EL 518)

–	–	–
–	–	–
–	–	–

EL 518
QE =

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES (EL 503)

1.5 / −17.0	1.4 / 3.9	1.3 / −4.1
1.8 / −17.7	1.7 / −0.8	1.6 / 4.5
1.9 / −17.5	1.7 / −0.8	1.8 / 6.8

EL 503
QE = 81

RIGHT WET WELL

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

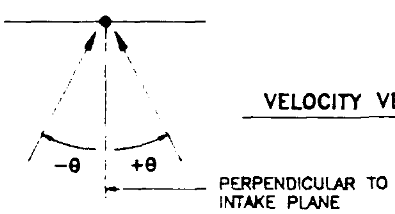
–	–	–
–	–	–
–	–	–

QE =

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–
–	–



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 14E

TOTAL Q = 99 CFS

LEFT WET WELL

SIDE INTAKES

EL 534

–	–	–
–	–	–
–	–	–

QE =

EL 518

–	–	–
–	–	–
–	–	–

QE =

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

–	–	–
–	–	–
–	–	–

QE =

EL 503

–	–	–
–	–	–
–	–	–

QE =

RIGHT WET WELL

FRONT INTAKES

0.2 / −59.8	0.2 / −39.7	0.2 / −44.2
0.2 / −54.2	0.2 / −18.6	0.1 / 13.8
0.2 / −36.5	0.2 / −7.1	0.3 / 20.0

QE = 22

0.6 / −23.2	0.6 / 0	0.6 / 21.8
0.8 / −20.5	0.7 / 0	0.7 / 14.2
0.7 / −22.7	0.7 / −10.1	0.7 / 0

QE = 77

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0
0 / 0	0 / 0	0 / 0

QE = 0

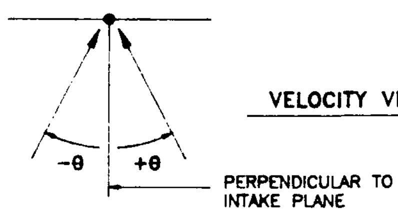
–	–	–
–	–	–
–	–	–

QE =

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–
–	–



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 15

TOTAL Q = 364 CFS

LEFT WET WELL

SIDE INTAKES

1.3 / −15.8	1.1 / −3.7	0.8 / −4.4
1.9 / −23.7	1.6 / −11.1	1.3 / 0
2.0 / −19.8	1.8 / −11.4	1.5 / −2.5

EL 534
QE = 69

FRONT INTAKES

2.4 / −24.9	2.0 / −2.1	1.9 / 11.9
2.2 / −1.9	2.1 / 2.6	2.4 / 25.2
2.5 / −22.2	2.2 / −5.8	2.1 / 10.4

QE = 102

RIGHT WET WELL

FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

LEFT WET WELL — SIDE INTAKES

–	–	–
–	–	–
–	–	–

EL 518
QE =

LEFT WET WELL — FRONT INTAKES

–	–	–
–	–	–
–	–	–

QE =

RIGHT WET WELL — FRONT INTAKES

4.2 / −18.7	3.9 / −4.2	3.8 / 5.8
4.7 / −21.8	3.9 / 1.4	4.3 / 14.3
4.3 / −14.6	4.0 / 3.1	4.2 / 15.1

QE = 193

RIGHT WET WELL — SIDE INTAKES

–	–	–
–	–	–
–	–	–

QE =

LEFT WET WELL — FRONT INTAKES

–	–	–
–	–	–
–	–	–

EL 503
QE =

RIGHT WET WELL — FRONT INTAKES

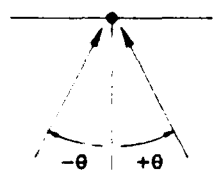
–	–	–
–	–	–
–	–	–

QE =

LEGEND

MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG / θ	–
–	–



PERPENDICULAR TO INTAKE PLANE

VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 16

TOTAL Q = 10 CFS

LEFT WET WELL

SIDE INTAKES

-	-	-
-	-	-
-	-	-

EL 534

QE =

-	-	-
-	-	-
-	-	-

EL 518

QE =

FRONT INTAKES

0.3 -38.3	0.3 16.0	0.3 -41.1
0.4 -33.4	0.3 -9.4	0.3 -41.6
0.4 -11.9	0.3 4.7	0.5 -57.8

QE = 10

-	-	-
-	-	-
-	-	-

QE =

-	-	-
-	-	-
-	-	-

EL 503

QE =

RIGHT WET WELL

FRONT INTAKES

-	-	-
-	-	-
-	-	-

QE =

-	-	-
-	-	-
-	-	-

QE =

-	-	-
-	-	-
-	-	-

QE =

SIDE INTAKES

-	-	-
-	-	-
-	-	-

QE =

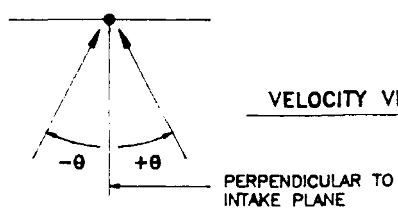
-	-	-
-	-	-
-	-	-

QE =

LEGEND

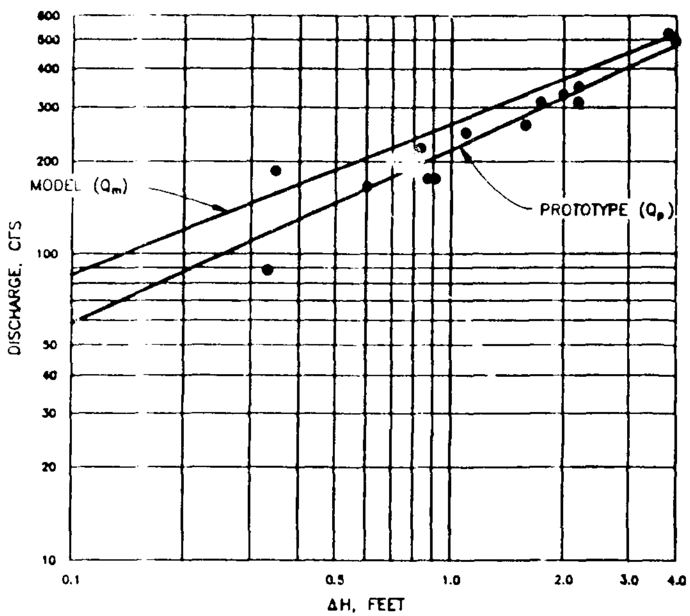
MAG = MAGNITUDE OF VELOCITY VECTOR, FPS
θ = ORIENTATION OF VELOCITY VECTOR (HORIZONTAL), DEGREES
QE = DISCHARGE, CFS (BASED ON AVERAGE VELOCITY AND EQUIVALENT EFFECTIVE INTAKE AREAS)

MAG θ	-
-	-



VELOCITY VECTOR ORIENTATION

INTAKE VELOCITY MEASUREMENTS
TEST 17



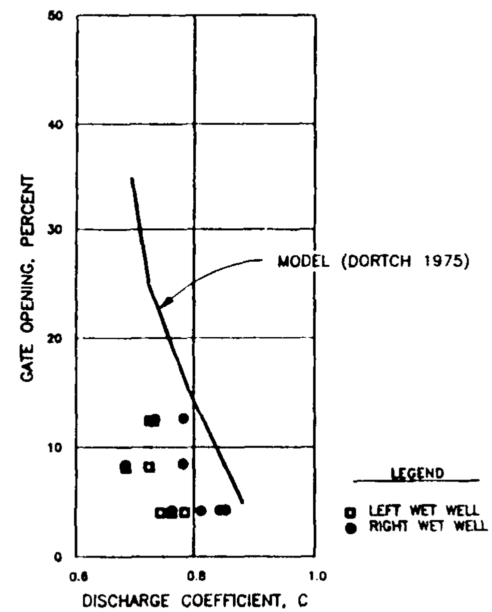
SUBMERGED FLOW CHARACTERISTICS FOR SINGLE 6' X 6' INTAKE

NOTE: ΔH IS HEAD DIFFERENTIAL BETWEEN WATER SURFACE LEVEL IN RESERVOIR AND WATER SURFACE LEVELS IN WET WELL(S).

EMPIRICALLY DERIVED DISCHARGE EQUATIONS:

Q_m = 265.1 (ΔH)^[illegible]

Q_p = 219.9 (ΔH)^[illegible]



WATER QUALITY SYSTEM

NOTE: PROTOTYPE COEFFICIENT DETERMINED FROM EQUATION:

$$Q = CA\sqrt{2gH}$$

WHERE: A = AREA OF SERVICE GATE OPENING
H = HEAD FROM POOL TO CENTER OF GATE OPENING.

DISCHARGE CHARACTERISTICS WATER QUALITY FLOW